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LES FORAMINIFÈRES DANS LE TERTIAIRE DES PHILIPPINES.

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24. L. tournoueri var. borneënsis)

DESCRIPTION DES ESPÈCES:

L. insulæ-natalis
L. richthofeni
L. formosa
L. inermis sp. nov.
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L. inflata
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AVANT-PROPOS.

Les explorations géologiques des Philippines et en particulier les récents travaux de M. Warren D. Smith publiés dans "The Philippine Journal of Science" ont montré que le Tertiaire de cet archipel était constitué: 1° à la base par un système inférieur avec couches de Charbon exploitées, qui a été attribué à l'Eocène, et 2° par un système supérieur miocène caractérisé par des calcaires à Orbitoïdes.

L'étude des Foraminifères qui m'ont été communiqués par le géologue précité, permet de préciser cette classification: on peut en effet subdiviser le système supérieur et distinguer 3 séries de couches.

I. Le système inférieur lignitifère caractérisé par l'association des *Nummulites* et des *Lépidocyclines*.

II. Le système moyen caractérisé par l'abondance des grandes *Lépidocyclines*, et la présence des *Alvéolines*.

III. Le système supérieur où abondent les petites *Lépidocyclines* et les *Miogypsina*.

Cette succession est la même que celle que l'on observe dans toute l'Indonésie et en particulier à Bornéo,[1] où ces trois divisions correspondent aux couches que j'ai distinguées par les lettres D,—E, F, G,—H. Elles peuvent être facilement parallélisées avec les couches de l'Aquitaine.

I. Le système inférieur D, partout caractérisé par l'association des Nummulites et des Lépidocyclines, représente le STAMPIEN ou Oligocène supérieur.[2]

II. Le système moyen E, F, G représente alors les couches de Peyrère et de St-Géours, c'est-à-dire l'AQUITANIEN.

III. Le système supérieur H se rattache complètement par sa faune aux couches de St-Etienne d'Orthe et surtout à celles de St-Paul près Dax (Abesse, Mandillot), gisement type du BURDIGALIEN.

Je vais passer en revue les différentes formes que j'ai pu examiner et je reviendrai en terminant sur les caractères comparatifs de ces faunes avec celles des autres parties de l'Indonésie, et celles de l'Europe.

DESCRIPTION DES ESPÈCES.

1° FORAMINIFÈRES IMPERFORÉS.

ALVEOLINELLA. Pl. A, fig. 1.

Ce genre est représenté par une série de moules médiocrement conservés dans une roche très tendre, jaunâtre, recueillie à Sibud Gulch, Old Alpaco Mines, Cebú, et portant le numéro 273. Cette roche est qualifiée de marne, mais c'est plutôt un grès tendre avec ciment calcaire peu abondant.

[1] Douvillé, H. Les Foraminifères dans le Tertiaire de Bornéo. *Bull. Soc. géol. France*, (1905), VI, 5, 435.

[2] Conformément aux travaux les plus récents, la limite entre l'Oligocène et le Miocène, ou entre l'Eogène et le Néogène est placée entre le Stampien et l'Aquitanien proprement dit.

Elle renferme un grand nombre d'empreintes de Foraminifères parmi lesquelles quelques unes sont fusiformes allongées, ayant environ 5 millimètres de longueur sur 1 millimètre de diamètre. Elles se rapportent incontestablement à des Alvéolinidés. Sur quelques échantillons il m'a semblé distinguer sur l'empreinte de la cloison terminale plusieurs rangées d'ouvertures. Ces fossiles appartiendraient donc au groupe de l'*Alv. quoyi*, pour lequel j'ai proposé le genre *Alveolinella*. A ce sujet je ne puis mieux faire que de citer l'observation très intéressante faite par M. Verbeek:[3] après avoir décrit plusieurs *Alveolina* des couches à Nummulites présentant tous *une seule rangée* d'ouvertures, il dit quelques mots de formes rares trouvées dans l'étage inférieur du terrain miocène, et il constate qu'elles présentent 3 et même 4 rangées d'ouvertures les unes au dessus des autres, "circonstance qui jusqu'à présent n'a jamais été observée, dit-il, chez des Alvéolines fossiles, mais seulement chez les espèces vivantes (*Alv. Quoyi*). Par là, les Alvéolines miocènes se distinguent nettement des espèces éocènes et oligocènes." Ces *Alveolinella* de Java sont indiquées comme associées à de nombreuses *Orbitolites* dans un calcaire grisâtre d'âge miocène ancien un peu au dessus des grès quartzeux éocènes. Elles sont un peu plus petites que l'espèce de Cebú, leur longueur maximum étant de 3.5 millimètres sur une épaisseur de 0.75 millimètre, mais il ne faut pas oublier qu'elles ont été seulement observées en coupe sur des plaques minces.

Gisement.—Dans les Philippines cette forme est accompagnée par des Orbitolites, des Operculines et des Polystomelles; les couches qui renferment cette faune sont riches en Mollusques, parmi lesquels on signale *Dolium costatum*. Martin[4] a eu l'occasion d'étudier un échantillon d'une marne terreuse tendre provenant de la mine même d'Alpaco et riche en coquilles de Lamellibranches et de Gastropodes. C'est vraisemblablement la même couche, la différence de couleur provenant de la différence de gisement, les roches jaunes en affleurements devenant habituellement bleues en profondeur; il signale dans cet échantillon un fragment de grande Lépidocycline, et en outre *Vicarya callosa*. De ces rapprochements il semble qu'on peut conclure que ces couches sont à la base du système moyen et représentent l'Aquitanien inférieur, comme à Bornéo et vraisemblablement aussi à Java.

Orbitolites martini? Verbeek. Pl. A, fig. 2.

La même roche jaunâtre de Old Alpaco Mine, renferme d'assez nombreux moules d'une Orbitolite mince ayant de 5 à 6 millimètres de diamètre. Sur les empreintes on distingue un grand nombre d'anneaux concentriques étroits ayant au pourtour environ 0.05 millimètre de largeur, constitués par des moules de logettes ayant à peu près la même distance d'axe en axe. C'est exactement la disposition figurée par M.

[3] Verbeek et Fennema, Description géologique de Java et Madoura (1896), 1141.
[4] *Centralbl. f. Mineral., Geol. u. Paläon.* (1901), 326.

Verbeek (Pl. IX, fig. 135). Malheureusement la disposition des loges en coupe verticale reste bien obscure: la figure 134 de cet auteur indique pour la forme type 2 rangées d'ouvertures, ce qui placerait cette forme dans les *Sorites;* mais c'est seulement un dessin et d'après le texte les coupes ne donnent pas de caractères précis. Dans les spécimens des Philippines l'impression du pourtour de la coquille semble indiquer des ouvertures en rangées plus nombreuses, tandis que les moules de logettes conservées sur les bases correspondraient peut-être à une couche superficielle rappelant celle des *Marginopora.*

Les deux formes sont donc incomplètement connues, et leur rapprochement n'est que probable.

Gisement.—Dans les Philippines cette forme accompagne les *Alveolinella,* dans des couches qui sont indiquées comme inférieures au Calcaire à *Orbitoïdes;* Aquitanien inferieur.

2° FORAMINIFÈRES PERFORÉS.

OPERCULINA.

Les couches du Miocène des Philippines renferment de nombreuses Operculines qui paraissent se rapporter à 2 types un peu différents.

Operculina costata d'Orb. Pl. A, fig. 3.

Operculina costata d'Orbigny, Prodrome, étage 20, Falunien B, (1852), n° 2881, 155.

C'est une forme très voisine de l'*Op. complanata* et qui s'en distingue par ce que la surface est ornée de côtes correspondant aux cloisons.

J'en rapproche une forme abondante dans des calcaires tendres jaunâtres de Minanga river (Cebú, n° 277) où elle est associée à de nombreux *Cyclocypeus communis;* elle atteint 7 à 8 millimètres dans son plus grand diamètre et se rattache nettement au groupe de l'*Op. complanata* par sa taille, la largeur du dernier tour et ses cloisons fortement et regulièrement arquées. Certains échantillons sont presque aussi lisses qu'*Op. complanata,* mais le plus grand nombre est fortement costulé et les costules se décomposent en granulations plus ou moins nombreuses; elles sont toujours plus accentuées dans le jeune.

Gisement.—D'après l'abondance du *Cycl. communis* dans ces couches, je les considère comme un peu plus récentes que les calcaires à grandes Lépidocyclines et représentant l'Aquitanien supérieur.

Operculina costata, var. **tuberculata.** Pl. A, fig. 4.

Je distingue sous ce nom des individus plus petits que les précédents, atteignant seulement 4 à 4.5 millimètres; ils sont plus renflés, de section lenticulaire et présentent de forts tubercules sur les côtes. Ils paraissent difficiles à distinguer des jeunes de l'espèce précédente; peut-être en représentent-ils seulement la forme A. Ils se distinguent de l'*Op. gaimardi* d'Orbigny, des mers actuelles par leur taille plus grande et leur forme plus renflée.

Ils se recontrent presque à tous les niveaux, mais ils sont surtout abondants dans les grès tendres de Old Alpaco Mine, où ils se présentent à l'état de moule (éch. n° 273).

HETEROSTEGINA. Pl. A, fig. 5.

Les *Heterostegina* de grande taille ne sont ordinairement pas rares dans les couches à Orbitoïdes.

J'en ai observé un bel échantillon de 5 millimètres de diamètre fixé sur une *Lepidocyclina insulæ-natalis* du Barrio de Mesaba.

Cycloclypeus communis Martin. Pl. A, fig. 6.

Cycloclypeus communis K. Martin, Untersuchungen über die Organisation von Cycloclypeus und Orbitoïdes. Niederland. Arch. f. Zoöl. (1880), 5, Pls. 13 et 14.

Carpenter a montré dès 1856 (*Phil. Trans. Roy. Soc. London* (1856), **146**, 547) la constitution de ce genre curieux. C'est en réalité une *Heterostegina* dont le développement est devenu annulaire (cyclostègue) et qui épaissit son test comme *Orbitoïdes*, mais sans former de logettes latérales; il existe donc comme dans ce dernier genre une couche équatoriale de logettes, mais elles sont rectangulaires comme dans *Heterostegina*. Les couches latérales sont compactes et plus épaisses au centre, ce qui donne aux échantillons une forme lenticulaire ordinairement très aplatie.

L'ornementation dans *Cycl. communis* est formée par une série de granules disposés suivant les anneaux d'accroissement, et correspondant à des piliers analogues à ceux des *Orbitoïdes*.

Cette espèce est très abondante dans les couches supérieures de l'île de Batan (éch. n° 8) où elle accompagne les *Myogipsina* et dans les calcaires tendres jaunâtres du Barrio de Mesaba (Cebú, n° 273), où elle est associée à *Operculina costata*. J'ai déjà montré précédemment que le premier niveau appartenait au Burdigalien, tandis que le second paraît devoir se placer au sommet de l'Aquitanien. Cette espèce dans les Philippines se montrerait ainsi à la base de H et dans G, à peu près au même niveau qu'à Bornéo; il est même possible que les calcaires tendres jaunâtres du Barrio de Mesaba représentent exactement les couches à silex du groupe F de Bornéo.[5]

ROTALIA.

J'ai pu extraire de la roche tendre de Old Alpaco Mines (éch. n° 273) de petits échantillons qui ressemblent beaucoup à *Rotalia schröteriana* Parker et Jones, avec ses lignes d'enfoncements le long des cloisons, mais qui en diffèrent par une forme moins dissymétrique. Il semble que Carpenter a eu sous les yeux une forme bien voisine quand il dit:[6] "dans une remarquable variété des îles Fidji la spire est plus symétrique . . . . . de sorte que la coquille a presque la même forme que *Polys-*

[5] *Bull. Soc. géol.* France (1905), IV, 5, 445. [6] Introduction, 213.

tomella craticulata; elle se rapproche du reste beaucoup de ce type par la disposition du dépôt exogène et par la manière dont les passages interseptaux s'ouvrent extérieurement le long du bord des cloisons." A la page suivante il revient sur ces analogies avec *Polystomella,* qui montrent que ces deux types sont extrêmement voisins l'un de l'autre. Il est curieux de retrouver aux Philippines ces deux formes associées dans le même gisement.

POLYSTOMELLA.

Forme voisine de *P. craticulata,* mais à callosité ombilicale un peu moins large et moins développée; on sait que ce genre est abondant à partir du Tertiaire moyen. Cette forme est associée à la précédente dans le grès tendre de la vieille mine d'Alpaco (éch. n° 273).

Une forme très voisine est indiquée par des sections dans les calcaires oligocènes à petites Nummulites de Caracaran de l'île de Batan (éch. n° 2). Une coupe axiale passant par le centre montre que c'est bien un *Polystomella* et non un *Rotalia.* Ce type aurait donc apparu dès la fin de l'Oligocène.

Nummulites subniasi sp. nov.

Nummulina variolaria Brady, On Some Fossil Foraminifera from the West Coast District of Sumatra. *Geol. Mag.* (1875), II, 2, 552.

Les calcaires subordonnés aux couches de charbon de l'île de Batan renferment de nombreuses petites Nummulites qu'il ne semble pas possible de distinguer de celles que M. Verbeek a recueillies autrefois dans l'île de Nias et qui ont été décrites et figurées par Brady sous le nom de *N. variolaria;* cet auteur donne comme dimension maximum 2 millimètres et ses figures indiquent bien des individus mégasphériques. Les échantillons des Philippines sont légèrement plus grands, 2.7 millimètres, et sont également mégasphériques comme l'indique la coupe ci-jointe.

La forme de la spire, la direction et la courbure des cloisons concordent parfaitement.

En 1896, M. Verbeek a repris l'étude de cette espèce et a figuré à nouveau sous le nom de *Nummulites niasi* II, une forme un peu plus grande, ayant un diamètre de 4 millimètres mais certainement microsphérique comme le montre le diamètre de la loge initiale pour lequel M. Verbeek donne la dimension de 0.02 millimètre. Comme le *Nummulites niasi* I Verbeek est incontestablement une Amphistégine, on pourra réserver à la *N. niasi* II microsphérique le nom spécifique de *niasi* Verbeek, et donner à notre forme mégasphérique le nom de *subniasi.*

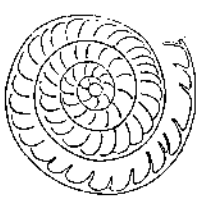


FIG. 1.—*Nummulites subniasi* sp. nov. de la formation charbonneuse de l'île de Batan, gr. 10 fois.

LEPIDOCYCLINA.

Dans un mémoire précédent et à l'exemple de MM. Verbeek et Fennema, j'ai divisé ce genre en deux sections, pour lesquelles j'ai proposé les noms suivants:

1° Les *Eulepidina* généralement de grande taille, caractérisées par leurs loges équatoriales en spatule ou en hexagone subrégulier et par leur nucleus du type embrassant.

2° Les *Nephrolepidina*, presque toujours petites, à loges équatoriales ogivales, en losange ou en hexagone allongé et à nucleus du type réniforme.

Je vais examiner séparément chacun de ces groupes.

1° Section des **Eulepidina.**

Dans les Philippines ces grandes formes paraissent cantonnées dans les Calcaires à Orbitoïdes inférieurs et dans les marnes subordonnées; le Tertiaire de cet archipel présente de telles analogies avec celui des Archipels voisins, qu'il n'est pas possible de séparer l'étude de leurs fossiles. Je passerai donc tout d'abord rapidement en revue les espèces qui ont été proposées dans cette région. Elles sont malheureusement le plus souvent très incomplètement définies et il ne sera pas toujours possible de les caractériser d'une manière certaine.

L'étude approfondie que j'ai pu faire des différentes espèces de *Lepidocyclina* m'a montré que les caractères les plus précis sont fournis par la disposition des piliers et des logettes latérales; ces caractères ne sont que très rarement indiqués, les espèces étant principalement établies sur de simples sections.

Fig. 2.—*Lepidocyclina sumatrensis*, gr. 6 fois, d'après la figure originale de Brady.

C'est Brady qui en 1875 [1] a décrit et figuré les premières espèces d'après des échantillons recueillis par M. Verbeek et envoyés par ce géologue à Rupert Jones; ils provenaient en particulier de l'île de Nias. La plupart des formes ont été attribuées à tort à des espèces déja connues, *Nummulina variolaria, N. ramondi, Orbitoïdes papyracea, O. dispansa;* une seule espèce nouvelle est proposée:

Fig. 2bis.—Section d'un échantillon de l'île de Nias, gr. 10 fois.

(1) *Orbitoïdes sumatrensis,* très bien figurée (loc. cit. Pl. XIV, fig. 3, ab.); c'est une forme globuleuse, presque sphérique, ayant environ 3 millimètres de diamètre, sur une épaisseur de 2.5 environ. Elle présente à l'équateur une mince collerette très étroite, dont le contour présente

[1] *Geol. Mag.* (1875), 2, 532. On Some Fossils Foraminifera from the West Coast District of Sumatra.

des parties saillantes dessinant une sorte d'étoile; la première loge paraît très petite.

Elle a été recueillie dans l'île de Nias. M. le Dr Verbeek a bien voulu me communiquer plusieurs échantillons provenant de la localité type. J'ai pu m'assurer ainsi qu'elle appartenait à la section des *Nephrolepidina*. Elle diffère très notablement des formes de l'Aquitaine qui en ont été rapprochées.

Quelques années après, en 1880, le professeur K. Martin[8] a fait connaître de nouvelles espèces qu'il range avec raison dans les *Lepidocyclina*.

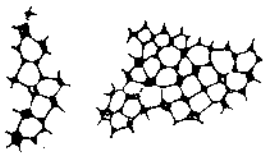


FIG. 3.—*Lepidocyclina carteri* Martin, disposition des piliers près de la surface, gr. 20 fois.

(2) *Orbitoïdes carteri* (loc. cit., p. 11, Pl. XIV, fig. 2, 2a, 2b, 2c); elle est lenticulaire et légèrement renflée au centre, elle atteint un diamètre de 26 millimètres avec une épaisseur maximum de 2 millimètres. La surface ne montre d'après l'auteur aucune ornementation; toutefois la fig. 2a montre des piliers inégaux, pentagonaux, quadrangulaires, ou triangulaires dont l'épaisseur est indiquée comme étant de 0.05 à 0.12 millimètre. Sur une des préparations qui m'a été communiquée par le professeur R. Martin, on distingue des piliers peu développés se présentant comme des épaississements des points de rencontre des cloisons, peu nombreux et irrégulièrement distribués; ils sont triangulaires, quadrangulaires et très exceptionnellement pentagonaux. Mais la préparation est très voisine de la couche équatoriale et il est possible que les piliers se développent davantage dans les couches plus extérieures et dans la partie centrale qui est un peu renflée; et en effet, les coupes axiales montrent de gros piliers qui sont probablement des pustules et qui atteignent la dimension indiquée de 12 millimètres. Les logettes latérales ont de 0.08 à 0.11 millimètre de diamètre et leurs parois 0.03 à 0.035 d'épaisseur. Elles forment des couches très nombreuses, 30 environ au centre. La figure 2b montre les perforations du toit de certaines logettes sous la forme de fins canaux parallèles.

La gangue est un tuf grossier renfermant des fragments de roche éruptive et de nombreux *Cycloclypeus communis*.

La localité originaire est au Nord de Sindangabaran? (Java). D'après la forme des logettes équatoriales cette espèce appartient bien certainement à la section des Eulepidina.

(3) *Orbitoïdes gigantea* (loc. cit., p. 20, Pl. XIV, fig. 3, 3a, 3b, 3c, 3d) diffère de la précédente par sa taille plus grande, presque double, 50 millimètres; la forme générale est la même. Une section tangentielle

[8] Untersuchungen über die Organisation von Cycloclypeus und Orbitoïdes. *Niederl. Arch. f. Zoöl.* (1880), 5.

communiquée par le professeur K. Martin, montre une série de piliers assez gros atteignant 0.15 millimètre et entourés de 6 à 7 logettes; ils constituent donc de véritables pustules, assez souvent séparées par deux rangées de logettes; celles-ci sont de forme assez irrégulière et leur plus grande dimension varie de 0.1 à 0.2 millimètre.

D'après l'auteur cette espèce se distingue aussi de la précédente par ses logettes latérales plus hautes et formant des couches moins nombreuses.

L'espèce est fondée sur un seul échantillon incomplet provenant de Tjidamar (Java).

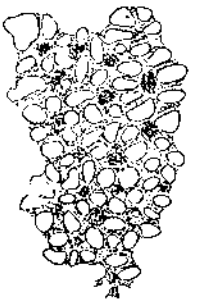


FIG. 4.—*Lepidocyclina gigantea* Martin, disposition des piliers près de la surface, gr. 20 fois.

(4) *Orbitoïdes radiata* (loc. cit., p. 22, Pl. XIV, fig. 4) présente sur sa surface un bouton central d'où partent 9 rayons saillants qui n'atteignent pas le bord. Elle provient de la même localité que l'*O. carteri*. L'auteur l'a d'abord rangée dans les *Actinocyclina*, mais il a reconnu plus tard [9] que c'était une véritable *Lepidocyclina*.

Le même auteur avait décrit [10] en 1891 une cinquième espèce:

(5) *Lepidocyclina multipartita*, petite forme de 6 à 7 millimètres de diamètre, très renflée au milieu et présentant quelques grosses pustules; la couche équatoriale se renfle beaucoup à la périphérie et elle se subdivise alors dans la hauteur d'une manière irrégulière. Elle appartient vraisemblablement à la section des *Nephrolepidina*. Elle provient des couches à *Cycl. annulatus*.

En 1896, MM. Verbeek et Fennema [11] publiaient leur grand ouvrage sur l'île de Java et donnaient d'excellentes figures d'un grand nombre de Foraminifères, *Alveolina, Nummulites, Operculina, Orbitoïdes*, etc. Ils indiquent pour la première fois que les Orbitoïdes à loges équatoriales rectangulaires (distinguées en 1868 par Gumbel sous les noms de *Discocyclina, Rhipidocyclina, Aktinocyclina*, et *Asterocyclina*, réunies plus tard en 1891 par Munier-Chalmas sous celui d'*Orthophragmina*), se recontrent exclusivement dans le tertiaire ancien avec les *Nummulites*, tandis que les *Lepidocyclina* caractérisent le Miocène.

Ces auteurs distinguent dans ce dernier genre 6 espèces réparties en 3 couples, mais sans leur donner de noms: le premier avec des logettes équatoriales en losange appartient à la section des *Nephrolepidina*: il comprend les formes microsphériques I A (*a, d, h, l*) et mégasphériques I B (*g, k*). Les deux autres ont des logettes équatoriales en spatule et font partie de la section pour laquelle j'ai proposé le nom de *Eulepidina;*

[9] In Schlumberger, 1900.

[10] *Samml. Geol. Mus. Leiden* (1881), Neue Folge, 1, Heft 5, 7, Pl. 1. fig. 7–10.

[11] Description géologique de Java et Madura.

elles sont petites, 5 à 6 millimètres, II C (*f*) et II D (*e*), ou grandes, atteignant jusqu'à 70 millimètres, III E (*b, m, n*) et III F (*c, c. p*). Ils considèrent les *O. carteri* et *O. gigantea* comme se rapportant probablement à l'espèce III E, et ils ajoutent que "certaines espèces se rencontrant dans 2 ou même 3 étages, il ne semble pas qu'elles puissent convenir pour établir des subdivisions dans les couches néogènes."

En 1899, Newton et Holland,[12] reprennent l'étude des principales formes décrites par Brady: c'est ainsi qu'ils donnent le nom de (6) *Lepidocyclina verbeeki* a l'*Orb. papyracea* de Brady à laquelle ils réunissent les formes *g* et *k* de Verbeek et Fennema. Or, ces différentes formes sont mégasphériques et l'*O. papyracea*, de même que la forme *k*. proviennent de Padang; le nom de *Lep. verbeeki* doit donc strictement être réservé pour les formes mégasphériques de Padang. J'en ai sous les yeux un grand nombre d'échantillons communiqués par M. Verbeek et provenant de la localité type; ils ont de 5 à 7 millimètres de diamètre; ils sont amincis sur les bords et assez fortement renflés au centre; quand la surface est bien conservée elle est lisse mais on y distingue néanmoins une vingtaine de petites pustules subégales ayant de 0.15 à 0.2 millimètre; cette disposition est assez bien indiquée sur une coupe tangentielle figurée par Newton et Holland (loc. cit., Pl. IX, fig. 10) dans laquelle cependant les pustules sont plus petites et paraissent indiquer un individu jeune.

Vers 1900, Rupert Jones et Chapman ont décrit et figuré[13] un grand nombre d'Orbitoïdes provenant de l'île Christmas; malheureusement les échantillons n'ont pas été isolés et les espèces ne sont établies que sur des sections effectuées dans la roche qui les contient et, par suite, d'une orientation incertaine: aussi la plupart d'entre elles doivent être considérées comme insuffisamment définies.

Ainsi (7) *L. meodispansa,* rapprochée de la forme *d* de Verbeek et Fennema est une *Nephrolepidina* de 5 millimètres de diamètre qui ressemble beaucoup à *Lep. verbeeki;* cependant les pustules paraissent plus grosses et moins nombreuses. Le caractère distinctif, indiqué par les auteurs et fondé sur le renflement plus brusque de la partie centrale, n'est guère applicable. En outre, il ne semble pas d'après les sections figurées que l'espèce soit microsphérique comme *d* de Verbeek et Fennema.

(8) *L. insulæ-natalis* est exceptionellement susceptible d'une définition plus précise. Sa grande taille, 12.5 à 19 millimètres, la range

[12] On some tertiary Foraminifera from Borneo and their comparison with similar forms from Sumatra. *Ann. & Mag. Nat. Hist.* (1901), VII, 7, 215.

[13] On the Foraminifera of the Orbitoidal limestones and reef rocks of Christmas island. Ce mémoire fait partie d'une monographie de ces îles; le tirage à part ne porte ni titre général, ni date, ni indication d'éditeur. On sait que l'île Christmas est située à environ 3 degrés 1/2 de latitude au Sud de la pointe occidentale de Java.

dans les *Eulepidina;* la figure type (loc. cit., Pl. XX, fig. 5) est une section oblique et ne passant pas par le centre, comme le montre l'inégalité des deux moitiés. Il en résulte que la moitié la plus grande représente une coupe en partie perpendiculaire au rayon, c'est à dire tangentielle. Elle montre bien la disposition des piliers, qui, comme l'indique expressément l'auteur, "entourent les logettes polygonales." Cette disposition est bien indiquée sur la figure ci-jointe qui représente un grossissement de la figure type; elle est tout à fait caractéristique du groupe du *Lepidocyclina dilatata.*

Fig. 5.—Reproduction grossies 5 fois de la partie centrale de la figure type de MM. Rupert Jones et Chapman, le grossissement de cette dernière figure n'est pas indiqué.

C'est donc à tort que Schlumberger a attribué à cette espèce un échantillon de Java dont la surface présente de nombreuses pustules *entourées par* les logettes. Cette disposition est inverse de la précédente et il faudra conserver pour l'espèce de ce dernier auteur le nom qu'il avait tout d'abord choisi *L. ngembaki.*

(9) *L. ephippioïdes* est rapproché à la fois de l'espèce précédente qui est un *Eulepidina* et de *L. verbecki* qui est un *Nephrolepidina;* c'est dire combien elle est vaguement définie. L'épaisseur des cloisons pourrait faire penser à une forme du groupe de *L. formosa* Schlumb.

(10) *L. murrayana* à 4 rayons n'est probablement pas une forme étoilée comme l'ont pensé les auteurs, mais simplement une forme en selle; les caractères donnés sont dès lors tout à fait insuffisants.

(11) *L. andrewsiana;* le seul caractère indiqué est le fort renflement central avec large collerette, il est également insuffisant.

En 1900, Schlumberger [14] décrit deux nouvelles espèces de Lépidocyclines:

(12) *L. ngembaki,* qu'il attribue à tort à *L. insulæ-natalis* J. et Ch. comme je viens de le montrer. Dans cette dernière espèce les piliers restent polygonaux, se rejoignent en grossissant et entourent les logettes, tandis que dans la nouvelle espèce les piliers restent isolés et se transforment en pustules entourées chacune par une rosette de logettes. Cette disposition est très nettement indiquée par l'auteur (loc. cit., Pl. VI, fig. 4) sur une coupe tangentielle grossie 20 fois. Il faut donc reprendre le nom que l'auteur avait adopté tout d'abord, avant d'avoir reçu le mémoire de Rup. Jones et Chapman (loc. cit., p. 130).

Les piliers sont très petits et ne dépassent pas 0.1 millimètre, tandis que les logettes qui les séparent ont au centre seulement 0.06 de largeur.

L'échantillon type avait été recueilli à Ngembak (Java) par M. Verbeek.

[14] Notice sur deux espèces de Lépidocyclines des Indes néerlandaises. *Samm. d. geol. r. Museums in Leiden* (1900) I, 6, fasc. 3, 128.

(13) *L. martini* (loc. cit., p. 131, Pl. VI, fig. 5 et 8) est une forme étoilée de Batoe Koetjing (résidence de Madoera) qui a été rencontrée dans les Calcaires à *Cyclocypeus*.

Le même auteur publiait un peu plus tard [15] en 1902 une troisième espèce de Lépidocycline: (14) *L. formosa* qui mérite de nous arrêter un instant. Elle n'est connue que par des coupes; or l'une d'elles (loc. cit., Pl. VII, fig. 2) montre une partie centrale quadrangulaire prolongée aux 4 sommets par des branches étroites. L'auteur a pensé qu'il s'agissait d'une forme rayonnée: en réalité c'est simplement une forme discoïde recourbée en selle: on sait que dans ce cas la couche équatoriale se rapproche d'un hyperboloïde dont les sections dans le voisinage du plan tangent au centre sont constituées par deux hyperboles: de là les 4 branches de la figure précitée.

Au centre cette coupe montre un nucleus du type embrassant. Grâce à l'obligeance de M. le Professeur Haug j'ai pu retrouver dans la collection Schlumberger, conservée à la Sorbonne, une moitié de l'échantillon dont il vient d'être question; une préparation tangentielle a montré la disposition des logettes latérales séparées par des cloisons épaisses et paraissant dépourvues de piliers. Sur un autre échantillon de la même provenance, les logettes atteignent 0.2 millimètre de diamètre et les cloisons qui les séparent ont en moyenne 0.1 millimètre d'épaisseur.

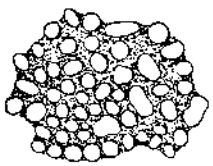


FIG. 6.—*Lepidocyclina formosa*, disposition des logettes sur une section de l'échantillon type de l'espèce, gr. 20 fois.

L'échantillon lui-même présente une partie centrale globuleuse atteignant 6 millimètre de diamètre avec une épaisseur de 4.2 millimètres (et non de 2 millimètres comme l'auteur l'indique par erreur): tout autour s'étend une collerette mince de 6 millimètres environ de largeur et de moins de 1 millimètre d'épaisseur.

Cette espèce provient de Teweh (Bornéo).

Newton et Holland avaient déjà publié en 1900 [16] quelques notes sur des Foraminifères de Formose; ils reviennent sur le même sujet en 1902 [17] et signalent dans ces calcaires une série de petites Lépidocyclines *L. sumatrensis*, *L. verbeeki* et une espèce nouvelle (15) *L. angularis* présentant un renflement central orné de grosses pustules et légèrement déprimé au centre, ce que indique l'existence d'une couronne de pustules plus développées que les pustules du centre; c'est une disposition qui rappelle celle de certaines *L. morgani*. Le diamètre est de 3 millimètres

[15] Sur un Lepidocyclina nouveau de Bornéo. *Ibid.* (1902), 6, 251.

[16] Notes on Microscopic Sections of Limestones from Formosa, Collected by Dr Koto of Japan. *Journ. Geol. Soc. Tokyo* (1900), 7, 1-4.

[17] On Some Fossils from the Islands of Formosa and Riu-Kiu (=Loo Choo). *Journ. Coll. Sc. Imp. Univ. Tokyo* (1902), 17, article 6.

avec 1 millimètre d'épaisseur; les auteurs indiquent la coexistence de formes micro-et mégasphériques.

Dans leur mémoire sur le genre *Lepidocyclina,* MM. Paul Lemoine et Robert Douvillé [18] ont décrit quelques formes provenant de Madagascar et de l'Afrique orientale allemande; ces gisements se rattachent étroitement à ceux des îles de la Sonde et font certainement partie du même bassin. Je laisse de côté parmi les espèces citées, *L. mantelli,* dont l'attribution principalement fondée sur des coupes axiales semble bien douteuse; *L. raulini* insuffisamment caractérisée et *L. morgani;* deux espèces nouvelles doivent être examinées de plus près: (16) *Lepidocyclina joffrei* est représentée par une coupe équatoriale et une coupe axiale et caractérisée surtout par la grandeur du nucleus qui atteint 2 millimètres; elle est considerée par les auteurs comme une simple race de la *L. dilatata;* les caractères des logettes latérales et des piliers ne sont pas indiqués; d'après les auteurs la surface serait lisse. Cette espèce aurait besoin d'être étudiée à nouveau.

La deuxième forme (17) *L. gallienii* ressemble beaucoup à L. *dilatata,* mais, disent les auteurs, les coupes montrent des loges environ deux fois plus petites linéairement, et séparées par de petits piliers fins (ce qui est parfaitement exact) mais un peu plus gros que ceux de *L. dilatata* (ce qui n'est vrai que pour les piliers que l'on observe sur les bords dans cette dernière espèce, ceux du milieu étant au contraire beaucoup plus gros.) Néanmoins les auteurs ont parfaitement saisi le caractère principal de cette espèce, caractère du reste commun avec presque toutes les formes de l'Extrême Orient d'avoir les logettes bien plus petites que les espèces de la région méditerranéenne.

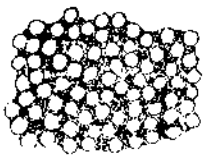


FIG. 7.—*Lepidocyclina gallienii* de Madagascar; coupe près de la surface montrant la disposition des piliers, gr. 20 fois.

J'ai sous les yeux le type de l'espèce: la surface extérieure polie montre des logettes très arrondies ayant en moyenne 0.1 millimètre de diamètre séparées par des cloisons épaisses avec de nombreux piliers aux points de croisement de ces cloisons, quadrangulaires, pentagonaux ou hexagonaux ayant à peu près la même largeur que les cloisons. Ces piliers couvrent à peu près toute la surface de la coquille à l'exception de la zone marginale.

On voit que cette forme est très voisine de (2) *L. carteri:* les dimensions des logettes sont analogues, mais dans cette dernière espèce les piliers paraissent moins développés.

Plus récemment M. Warren D. Smith a publié une série de travaux très importants sur la géologie des Philippines; il a décrit et figuré plusiers espèces de Lépidocyclines.

[18] *Mém. Soc. géol. de France,* Paléontologie, (1904), 12, n° 32.

En 1906 il a étudié les Orbitoïdes de Binangonan.[19] Cette localité avait été signalée par Richthofen,[20] qui disait y avoir recueilli une grande quantité de Nummulites de diverses grosseurs et appartenant à plusieurs espèces. M. Warren D. Smith n'y a trouvé que des Lépidocyclines: il décrit et figure sous le nom de (18) *Orbitoïdes richthofeni* (loc. cit., Pl. I, fig. 1) une espèce de grande taille qui devait atteindre 36 millimètres de diamètre avec une épaisseur maxima de 8 millimètres. L'auteur a bien voulu me communiquer la préparation figurée: c'est une section oblique et ne passant pas par le centre, comme le montre l'inégalité des deux moitiés, de part et d'autre du plan équatorial. Au milieu du côté le plus large on distingue un élément de coupe tangentielle (c'est à dire perpendiculaire au rayon) dans laquelle on voit que les logettes sont séparées par des cloisons très épaisses; c'est un caractère que l'on ne retrouve que dans le groupe de la *Lep. formosa*. D'un autre côté l'échantillon est partiellement dissous dans la region périphérique, les piliers plus résistants devraient être conservés; or il font défaut, ce qui indique qu'il n'en existait probablement pas. On peut chercher à se rendre compte de l'épaisseur des cloisons par leur largeur minima dans la coupe, elle est environ la moitié de celle des logettes. Ces caractères indiquent bien une espèce du groupe de *L. formosa*, mais la forme générale parait assez différente, l'échantillon étant beaucoup moins globuleux. Il serait donc nécessaire d'examiner d'autres échantillons pour préciser les caractères de l'espèce.

La figure 2 de la même planche reproduit la section d'un autre échantillon bien plus voisin par sa forme et l'ensemble de ses caractères de *L. formosa*.

Peu après le même auteur[21] publiait la description d'une série de fossiles provenant également de l'île de Luzon, mais au Sud de Manille. Dans cette région le Miocène à *Vicarya callosa* repose directement sur des roches éruptives; il signale dans ces couches et décrit sous le nom de (19) *Orbitoïdes martini* une Lépidocycline (loc. cit., p. 628, Pl. IV, fig. 6, 7, 8) de forme lenticulaire dont le diamètre varie de 15 à 50 millimètres. J'ai entre les mains la coupe axiale (fig. 8), elle ne montre pas de piliers nets, mais seulement des parois de loges un peu épaissies.

L'auteur dit que des formes analogues sont abondantes dans les calcaires de Cebú; je serai en effet porté à en rapprocher les échantillons de la vallée de Cumajumayan (éch. n° 285). Mais comme le nom de *L. martini* a déjà été employé en 1900 par Schlumberger, il ne peut être conservé.

[19] *This Journal* (1906), 1, 203.

[20] Ueber das workommen von Nummulitenformation auf Japan und den Philippinen. *Ztsch. deutch. Geol. Ges.*, (1862), 14, 357.

[21] Preliminary Geological Reconnaissance of the Loboo mountains of Batangas Province. *Ibid* (1906), 1, 617.

Tout récemment des travaux importants ont été publiés en Italie sur des Foraminifères recueillis par le Dr Bonarelli dans les îles de la Sonde.

C'est d'abord un mémoire de Mlle Giuseppina Osimo [22] sur des Foraminifères de Dongola, sur la côte occidentale de Celebes, à l'entrée de la baie de Palos. Parmi les formes figurées et décrites par l'auteur je signalerai une série de petites ou très petites Nummulites à filets rayonnants parmi lesquelles *N. elegans*, d'après laquelle l'auteur attribue ce niveau au Bartonien; *Amphistegina niasi* et deux Lépidocyclines: *L. tournoueri* et une forme nouvelle (20) *Lepidocyclina provalei*, représentée par un seul exemplaire de 7 à 8 millimètres de diamètre et une épaisseur d'environ 5 millimètres. Toute la surface est couverte de granulations saillantes de grosseur croissante de la périphérie vers le centre, où elles atteignent 0.2 millimètre; elles sont séparées d'après l'auteur par une seule rangée de logettes. Cette disposition rappelle tout à fait celle de *L. ngembaki*, mais ici les piliers sont moins uniformes et atteignent au centre une grosseur presque double.

Immédiatement après, le même recueil a publié deux mémoires de Mlle Irène Provale [23] sur des Foraminifères de Bornéo recueillis également par le Dr Bonarelli. Ils proviennent de différentes localités, et l'auteur distingue plusiers niveaux différents: un niveau inférieur à petites Nummulites et à *Orthophragmina* attribué a l'Eocène supérieur, un niveau moyen à *Lépidocyclina schlumbergeri, raulini, tournoueri* et à *Nummulites fichteli* représentant l'Oligocène et un niveau supérieur miocène à petites Lépidocyclines. Il est peu probable que les Lépidocyclines du niveau moyen soient identiques aux espèces de France dont l'auteur les rapproche; en particulier les figures données de *L. raulini* indiquent une forme à logettes bien plus petites, mais les descriptions sont insuffisantes pour déterminer leurs affinités réelles.

Dans la deuxième partie l'auteur figure une *Lep. formosa* certainement analogue au type, mais en différant par sa forme bien moins globuleuse, et une *L. insulæ-natalis*, espèce à laquelle il rapporte le *L. ngembaki* de Schlumberger et *L. provalei* de Mlle Osimo.

Ces deux dernières espèces sont en effet très voisines comme je viens de l'indiquer, mais elles sont très différentes du *L. insulæ-natalis* (8) comme je l'ai fait voir précédemment. Du reste l'échantillon figuré sous ce nom (Pl. III, fig. 4, 5, 6) est extrêmement globuleux et rappellerait plutôt *L. sumatrensis*.

Une curieuse espèce nouvelle est (21) *L. ferreroi* qui avait été recueillie il y a déjà longtemps à Sumatra par M. Verbeek et à Madagascar

[22] Di alcuni Foraminiferi dell'eocene superiore di Celebes. *Rivista italiana di Paleontologia*, Anno XIV (1908), 28-54, Pl. I-III.

[23] Di alcune Nummulitine e Orbitoidina dell' isola di Borneo, deux parties. *Rivista italiana di Paleontologia*, Anno XIV (1908), 55-80, Pl. IV-VI et Anno XV (1909), 65, Pl. II, III.

par M. Lemoine. Elle est caractérisée par 3, 4 ou 5 grosses pustules saillantes placées à une certaine distance du centre.

Il faut signaler encore plusieurs variétés de *Lep. tournoueri* à rapporter probablement à *Lep. verbeeki:*

1. Var. *angulosa* (22) (loc. cit., Pl. II, fig. 13, 14, 15), caractérisée par 5 grosses pustules disposées en couronne autour du centre: paraît voisine de *L. angularis* (15) de Newton et Holland.

2. Var. *inflata* (23) (loc. cit., Pl. III, fig. 14, 15) avec une grosse pustule au centre.

3. Var. *borneënsis* (24) (loc. cit., fig. 16–19) avec les granules uniformément répartis sur la surface et un nucleus souvent irrégulier et pluriloculaire.

Résumé.—Il resulte de cette longue révision qu'un assez grand nombre d'espèces de Lépidocyclines provenant des Indes Orientales[24] ont déjà été décrites par les différents auteurs; certaines formes ont été rapprochées des espèces d'Europe, tandis que d'autres ont été considérées comme spéciales. Une étude attentive montre presque toujours que les espèces indiennes sont différentes des formes européennes; en particulier le réseau est ordinairement à mailles notablement plus petites; ce caractère signalé par MM. Lemoine et R. Douvillé pour des formes de Madagascar paraît se retrouver dans toutes les espèces des Indes orientales. Il semble donc préférable d'être très réservé dans ces assimilations. Mais si ces deux groupes de formes sont différents, elles forment en réalité deux séries parallèles et constituées par des espèces correspondantes, c'est à dire présentant le même degré d'évolution.

J'ai précédemment groupé les espèces de Lépidocyclines en deux sections: *Eulepidina* et *Nephrolepidina* fondées sur la forme des loges équatoriales (en spatule ou en ogive) et sur la disposition du nucleus (deuxième loge embrassante ou réniforme); je vais examiner successivement les espèces qui ont été distinguées dans chacun de ces groupes.

Dans les *Eulepidina* les caractères les plus précis sont donnés par la disposition des piliers; il est facile de se rendre compte que ces derniers prennent naissance aux points de rencontre des cloisons des logettes équatoriales; les premières couches des logettes latérales correspondent aux logettes équatoriales et sont par suite à peu près hexagonales; on distinguerait alors sur leur pourtour 6 ébauches de piliers; chacun d'eux ayant une section triangulaire. Mais les piliers se développent inégalement tandis que les logettes se déforment plus ou moins rapidement. Dans les formes les moins évoluées les piliers restent polygonaux à 3.4 ou 5 côtés; ils forment une ceinture discontinue autour de chaque logette,

[24] Je comprends sous cette denomination l'ensemble des îles en bordure du continent depuis Madagascar jusqu'au Japon et les portions du rivage qui s'y rattachent au point de vue géologique.

c'est le stade n° 1. Presque toujours les piliers se développent davantage dans la partie médiane ordinairement renflée, mamillée, ils se rejoignent alors assez souvent et entourent plus ou moins complètement les logettes, c'est le stade n° 2.

Dans un troisième cas les piliers qui se développent sont moins nombreux et restent isolés tout en étant encore polygonaux à 3.4 ou 5 côtés (stade n° 3).

Enfin ils peuvent prendre une importance plus grande et autour de chacun d'eux on distingue une sorte de rosette formée de nombreuses logettes; on dit alors que les piliers sont devenus des pustules (stade n° 4). Cette disposition peut se développer seulement dans le mamelon central ou envahir une partie plus ou moins grande de la surface de la coquille.

D'une manière générale une même section tangentielle oblique pourra montrer en se dirigeant de la couche équatoriale vers le centre les différents stades de développement des piliers, et c'est d'ordinaire au centre que ceux-ci seront le plus spécialisés.

Une disposition toute différente se rencontre dans certaines espèces où toutes les cloisons s'épaississent sans former de piliers proprement dits (stade n° 5).

Exceptionnellement les piliers peuvent ne pas se développer et manquer complètement. Nous distinguerons cette disposition comme stade n° 0.

D'après ces considérations on peut distinguer parmi les espèces déjà connues:

1° *Lepidocyclina carteri* Martin (2.1880) caractérisé par le stade n° 1, nombreux petits piliers a 3, 4, ou 5 côtés. La coquille est mince, à peine renflée au centre où les piliers ne présentent pas de développement spécial. On sait que les couches latérales sont minces et très nombreuses.

2° *Lepidocyclina gallienii* Lemoine et R. Douvillé (17.1904) présente comme l'espèce précédente de très nombreux piliers à 3.4 ou 5 côtés. Ils sont un peu plus développés, les cloisons sont plus épaisses et les logettes latérales plus arrondies; mais ces différences ne sont guère que des différences de races. En outre il n'était pas possible de s'en rendre compte au moment où l'espèce de Madagascar a été établie, le *L. carteri* étant très incomplètement défini.

3° *Lepidocyclina insulæ-natalis* J. et Ch. (8.1900); les piliers sont plus développés et viennent se rejoindre partiellement en formant autour des logettes une ceinture plus ou moins discontinue (stade n° 2); c'est au centre qu'ils atteignent leur développement maximum.

Les trois espèces qui précèdent et en particulier la dernière correspondent par la forme et le développement de leurs piliers à *L. dilatata*,

Mich. d'Europe; elles n'en diffèrent guère que par la plus grande finesse du réseau.

4° *Lepidocyclina gigantea* Martin (3.1880); les piliers sont moins nombreux, isolés les uns des autres et forment presque des pustules, séparés souvent par plusieurs rangées de logettes (stade n° 3); c'est une disposition qui rappelle celle de *L. elephantina* Mun. Chalm.

5° *Lepidocyclina provalei* Osimo (20.1908); les pustules sont ici nettement caractérisées et elles sont séparées par une seule rangée de logettes; leur grosseur augmente progressivement quand on se rapproche du milieu de la coquille.

6° *Lepidocyclina ngembaki* Schlumberger (12.1900) présente également des pustules bien caractérisées quoique très petites; elles sont séparées au moins au centre par une seule rangée de logettes, et elles sont de grosseur uniforme, ce qui distingue cette espèce de la précédente.

7° *Lepidocyclina formosa* Schlumberger (14.1902) se distingue de toutes les formes précédentes par l'épaisseur de ses cloisons, et l'absence de véritables piliers.

Dans les *Nephrolepidina* les pustules existent presque toujours, mais leur disposition fournit de bons caractères.

8° *Lepidocyclina verbeeki* N. et H. (6.1899), est la forme fondamentale correspondant à *L. tournoueri* Lem. et R. D., d'Europe. C'est comme cette dernière une forme mégasphérique et elle s'en distingue par son réseau beaucoup plus fin; il suffit pour s'en rendre compte de comparer les figures 8 de Newton et Holland [25] et 1 de Lemoine et Rob. Douvillé,[26] qui représentent les coupes équatoriales de ces deux espèces à un grossissement analogue, 20 et 18 fois.

Cette espèce présente de nombreuses pustules dont la grosseur va en croissant de la périphérie au centre.

On pourrait distinguer par des noms spéciaux les formes suivantes:

9° *Lepidocyclina inflata* Provale (23.1909) caractérisée par une très grosse pustule médiane.

10° *Lepidocyclina angularis* Newton et Holland (15.1902) présente une couronne de grosses pustules plus développées que les pustules médianes. Elle correspond à peu près au *Lep. morgani* d'Europe.

11° Enfin une forme très particulière est *Lep. ferreroi* Provale (21. 1908) dont la surface présente seulement 3 à 5 gros boutons saillants disposés en étoile autour du centre qui est déprimé.

Nous pouvons maintenant aborder l'examen des échantillons des Philippines, il sera facile de distinguer les formes suivantes:

[25] *Ann. & Mag. Nat. Hist.* (1899), VII, 3, pl. 9.
[26] *Mem. Soc. géol. Fr., Paléontologie* (1904), 12, Pl. III.

A. Section des **Eulepidina.**

1° Formes grandes, minces ou lenticulaires, avec mamelon central plus ou moins développé.

Lepidocyclina insulæ-natalis, J. et Ch. Pl. B, figs. 1, 2, 3.

Orbitoïdes (*Lepidocyclina*) *insulæ-natalis* R. Jones et Chapman, in Andrew's Christmas Island (1900), 242, Pl. XX, fig. 5, non Schlumberger.

Orbitoïdes de grande taille, atteignant 32 millimètres de diamètre, minces, à peine mamillés au centre. La surface est couverte de petites granulations ayant de 0.15 à 0.20 millimètre de diamètre, quadrangulaires ou pentagonales. Dans la partie centrale, elles arrivent souvent à se toucher et elles entourent alors les logettes. C'est bien là le caractère de cette espèce comme il a été indiqué précédemment.

Localités. Cette espèce a été recueillie au Barrio de Mesaba (Cebú, n° 272) (figs. 1, 2), une variété (fig. 3) provient de Guila-Guila (Cebú, n° 278) où elle est associée aux espèces suivantes; une coupe mince de cette dernière forme communiquée par M. Warren D. Smith a été reproduite Pl. A, fig. 7, avec un grossissement de 10 fois.

Lepidocyclina richthofeni Warren D. Smith. Pl. C, figs. 1, 2, 3.

Lepidocyclina richthofeni Warren D. Smith, Philip. Journ. Sci. (1906) **1**, 203.

J'ai indiqué plus haut les caractères assez peu précis de cette espèce: forme lenticulaire, logettes latérales séparées par des cloisons épaisses et absence de piliers ou piliers peu développés. Je réserverai cette dénomination pour les formes voisines de l'espèce précédente, mais avec peu ou point de piliers.

On retrouve ces caractères dans les échantillons de la vallée de Cumajumayan (Pl. C, fig. 3) (Cebú, n° 285); ils sont lenticulaires, mais moins gros que le type, qui est du reste indiqué comme le plus grand échantillon trouvé à Binangonan; leur diamètre ne paraît pas dépasser 25 millimètres avec une épaisseur de 6 millimètres. Les piliers sont peu développés et seulement dans la partie moyenne; vers le centre on n'observe guère que des cloisons épaissies rappellant celles de *L. formosa*. Seulement le réseau est bien plus serré et les logettes sont bien plus petites; elles se rapprochent beaucoup par leurs dimensions de celles des espèces précédentes.

Des échantillons très analogues ont été recueillis près de la mine de Compostela (Cebú, n° 289).

À Guila-Guila (Cebú, n° 278) les Lépidocyclines sont de forme un peu différente; elles sont généralement minces et assez fortement mamillées: les unes (Pl. C, fig. 2) ont seulement 20 à 22 millimètres de diamètre et présentent autour du mamelon central assez large un disque

épaissi de 18 millimètres de diamètre, au delà duquel la coquille s'amincit brusquement comme dans certains *Orthophragmina* (*O. bartolomei* Schlm.). Le réseau superficiel est très fin, les piliers sont à peine marqués et les cloisons séparatives sont épaissies.

D'autres échantillons, et ce sont les plus nombreux (Pl. C, fig. 1, 1b), sont plus grands et plus minces; ils atteignent 38 millimètres de diamètre, sont mamillés au centre où leur épaisseur est de 3.5 millimètres. La partie moyenne présente quelques piliers analogues à ceux de l'espèce précedente; mais au centre les piliers disparaissent et les cloisons sont plus ou moins épaissies. Ce caractère les distingue du *L. insulæ-natalis*, où les piliers sont au contraire plus développés dans la partie centrale.

2° Formes globuleuses avec collerette équatoriale.

Lepidocyclina formosa Schlumberger. Pl. D, figs. 2, 3, 4, et 5.

Lepidocyclina formosa Schlumberger, Samml. d. Geol. r. museums in Leiden. (1900), 1, 6, fasc. 3, 128.

Espèce de grandeur moyenne atteignant un diamètre probablement supérieur à 12 millimètres lorsque la collerette est bien entière. La partie centrale est globuleuse, presque sphérique; elle mesure ordinairement 6 millimètres de diamètre avec une épaisseur de 4.5 à 6 millimètres. Au delà le bord s'amincit brusquement et forme dans la région équatoriale une sorte de collerette toujours plus ou moins brisée; la plus grande largeur que j'ai observée est de 3 millimètres, mais celle-ci devait être notablement plus grande (Pl. D, fig. 1 et 2).

Cette espèce est nettement caractérisée par l'épaisseur des cloisons qui entourent les logettes latérales; la surface paraît lisse et les piliers semblent faire défaut ainsi que les granulations superficielles qui leur correspondent (Pl. D, fig. 3). L'épaisseur des cloisons peut atteindre 0.15 à 0.20 millimètre pour un diamètre de logettes légèrement supérieur. On observe du reste d'assez grandes variations dans ces dimensions et d'ordinaire les logettes sont plus grandes vers le milieu de la coquille.

Localités.—Cette espèce est très abondante près de la mine de Compostela (Cebú, n° 287) où elle est associée à *Lep. richthofeni* et à l'espèce suivante; elle a également été recueille à Guila-Guila (Cebú n° 278) où elle accompagne les variétés plates de l'espèce précédente.

Lepidocyclina inermis sp. nov. Pl. D, fig. 5.

On recontre près de la mine de Compostela des échantillons ayant la même forme que *L. formosa*, globuleux et bordés d'une collerette. Ils sont dépourvus de piliers comme cette espèce, mais les cloisons sont toujours minces; ils correspondent au stade n° 0, défini plus haut.

B. Section des Nephrolepidina.

Formes petites, lenticulaires, plus ou moins renflées; logettes ogivales; deuxième loge réniforme.

Lepidocyclina smithi sp. nov.

Les calcaires a Nummulites de l'île de Batan renferment des Orbitoïdes de 3 à 5 millimètres de diamètre, qui ne sont guère connues que par leurs sections. J'ai pu cependant isoler une de ces formes qui présente les caractères des *Nephrolepidina*.

FIG. 8.—*Lepidocyclina smithi*; coupe près de la surface parallèle au plan équatorial, montrant le grand développement des quatre piliers médians, gr. 20 fois.

Elle a 4 millimètres de diamètre et à sa surface on distingue 4 très grosses pustules qui viennent presque se rejoindre en laissant seulement entre elles 4 traînées de logettes qui dessinent une sorte d'X. En usant progressivement l'une des faces j'ai pu constater que les pustules en se rapprochant du plan équatorial, prenaient leur forme ronde habituelle. La couche équatoriale présente les logettes rhomboïdales caractéristiques. C'est une forme microsphérique.

Cette Lépidocycline provient d'une couche de calcaire intercalé dans le système lignitifère (échantillon n° 2).

Une préparation d'un calcaire de l'île de Batan (baie de Calanaga n° 4) dans lequel on observe de nombreuses *Nummulites* à test noir, montre la section verticale d'un *Orbitoïdes* avec 2 grosses pustules d'un côté et une de l'autre, mais c'est mégasphérique. C'est peut-être la forme A correspondant à l'espèce précédente.

Le type très particulier que je viens de décrire correspond à certaines variétés de la *L. præmarginata* d'Europe. Elle se distingue de cette espèce par ses 4 grosses pustules très rapprochées; elle rappelle également *L. ferreroi*, mais dans cette dernière les pustules sont beaucoup plus éloignées et donnent à la coquille une forme étoilée.

Lepidocyclina verbeeki N. et H. Pl. D, fig. 8.

Orbitoïdes papyracea Brady, Geol. Mag. Dec. II (1875), 532, Pl. XIV, fig. 1, non Boubée.

Lepidocyclina verbeeki Newton et Holland, Ann. & Mag. Nat. Hist. (1899), VII, 3, 257, Pl. IX, fig. 7, Pl. X, fig. 1.

Les formes types caractérisées par quelques pustules de grandeur moyenne sont assez rares. La figure 8 reproduit un de ces échantillons partiellement engagé dans la roche. Il provient du Calcaire blanc

supérieur de Cotabato Valley (île de Cebú, n° 279) où il est associé à la forme suivante et aux *Miogypsina*.

Lepidocyclina inflata Provale. Pl. D, fig. 6 et 7.

Lepidocyclina tournoueri var. *inflata Provale*, Riv. italiana in Paleontologia, Ann. XV (1909), 73, Pl. III, figs. 14, 15.

C'est une forme voisine de la précédente, mais qui s'en distingue par une très grosse pustule centrale, tantôt seule, tantôt entourée de pustules plus petites. C'est de beaucoup l'espèce la plus fréquente dans les calcaires blancs supérieurs de l'île de Cebú. C'est peut-être une simple variété de l'espèce précédente. Ce groupe de formes mégasphériques représente dans la province orientale celui du *Lep. tournoueri*, dont il se distingue par ses logettes équatoriales plus petites.

Lepidocyclina cf. **marginata** Mich.

Nummulites marginata Michlotti, Saggio Storico dei rizopodi caratteristici dei terreni Sopracretacei (1841), 45, Pl. III, fig. 4.

Lepidocyclina marginata Lem. et R. Douv., Sur le genre Lepidocyclina, Mem. Soc. geol. Fr. Paleont. (1904), 12, 16; Rob. Douvillé, Sur des Lépidocyclines nouvelles. Bull. Soc. géol. Fr. (1907), IV, 7, 307, Pl. X, figs. 7, 11, 12.

Les formes précédentes mégasphériques sont accompagnées d'une forme plus rare, un peu plus grande et microsphérique; elle présente de nombreuses pustules peu saillantes séparées par des logettes à parois épaisses et son diamètre atteint 7 millimètres. Mais les matériaux à ma disposition étaient insuffisants pour en permettre une description complète, et je l'ai considérée provisoirement comme une race du *Lep. marginata*.

Genre MIOGYPSINA.

Miogypsina irregularis, race orientalis. Pl. D, fig. 9 et 10.

Nummulites irregularis Michelotti, Saggio Storico die rizopodi caratteristici dei terreni Sopracretacei (1841), 45.

Miogypsina irregularis Sacco, Bull. Soc. belge de Géologie, (1893), 7.

Flabelliporus orbicularis Dervieux, Atti d. R. Acad. delle Scienze di Torino, (1893), 29.

Miogypsina irregularis Schlumberger, Bull. Soc. géol. de France (1900), III, 28, 328, Pl. II, figs. 1 à 7.

Cette forme est abondante dans les calcaires blancs supérieurs de l'île de Cebú; elle est très voisine de l'espèce d'Europe dont elle diffère seulement par ses gros granules plus espacées et occupant une plus grande partie de la surface.

Quelques échantillons plus petits ont été trouvés dans les calcaires tendres jaunâtres de Gaba Bay (île de Batan, n° 8) situés bien au dessus des couches charbonneuses; ils sont associés au *Cyclaclypeus* et à des Amphistégines.

Genre AMPHISTEGINA.

Très commun dans toutes les couches.

Amphistegina niasi Verbeek.

Nummulites Niasi I Verbeek, Verbeek et Fennema, Descr. geol. de Java et Madoura (1896), 1155, Pl. IX, figs. 120–122.

Dans les calcaires à Nummulites du système charbonneux de l'île de Batan.

Amphistegina cf. mamillata d'Orbigny.

Espèce de petite taille, ayant environ 1.5 millimètre de diamètre; le côté visible ressemble tout à fait à la figure qui a été donnée par Carpenter (Intr. pl. XIII, fig. 23); les différences dans le mode de terminaison des loges de la face inférieure tiennent peut-être à un meilleur état de conservation.

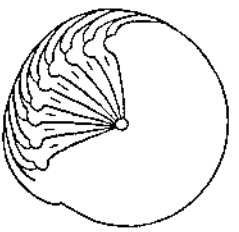


FIG. 9.—*Amphistegina cf. mamillata*, del' île de Batan, gr. 20 fois.

Localité.—Couche à *Cycloclypeus communis* de l'île de Batan (Gaba bay).

RÉSUMÉ ET CONCLUSIONS.

D'après l'étude qui précède on peut classer de la manière suivante les échantillons communiqués:

I. *Terrain éogène* (comprenant l'éocène et l'oligocène) Stage *Stampien.*

Calcaire de Caracaran (île de Batan,[27] éch. n° 2).

C'est un calcaire gris bleuâtre, sur lequel les Foraminifères se détachent en noir; il fait partie du système lignitifère et il est indiqué comme intercalé entre les couches de lignite.

Les plaques minces et les sections polies ont montré de petites Nummulites de 2.7 millimètre de diamètre, qui paraissent correspondre à *N. niasi* Verbeek; mais cette dernière espèce étant microsphérique, celle des Philippines, qui est mégasphérique, a du être distinguée comme *N. subniasi.* Le même calcaire renferme montre *Amphistegina niasi* Verbeek, *Polystomella* sp. et une curieuse *Lepidocyclina* de la section des *Neophrolepidina, L. smithi,* qui rappelle certaines variétés du *L. proemarginata.*

La coexistence des *Nummulites* et des Lépidocyclines caractérise le Stampien; il est à remarquer que ces deux genres ne sont représentés ici que par des formes de très petite taille, tandis qu'un peu plus au sud, à Bornéo, les grandes formes abondent.

II. *Terrain Néogène* (aquitanien, burdigalien, helvétien, etc.) Etage *Aquitanien.*

[27] The Coal Deposits of Batan Island par Warren D. Smith, 1905 (Bull. No. 5, the Mining Bureau, Manila).

1° Grès tendre jaunâtre de Sibud Gulch (old Alpaco Mine, île de Cebú,[28] éch. n° 273).

La roche est d'une faible dureté et le ciment calcaire est très peu abondant; les fossiles y sont à l'état d'empreintes et les caractères internes sont très difficiles à reconnaître. La faune se compose essentiellement d'*Orbitolites* et d'*Alveolinella;* il faut ajouter *Operculina costata,* var. *tuberculata, Rotalia, Polystomella.* Cette couche est indiquée comme supérieure au système lignitifère et inférieure aux calcaires à Lépidocyclines. Elle serait ainsi à peu près au niveau des couches à *Orbitolites* et *Alveolinella* de Java que M. Verbeek place dans son étage m, c'est-à-dire dans l'Aquitanien inférieur. Mais par suite de la conservation insuffisante des fossiles, cette attribution doit être considérée comme seulement provisoire. Il faut ajouter que M. le professeur Martin a signalé[29] des *Orbitoïdes* trouvées par Semper dans une marne d'Alpaco.

2° Le niveau le mieux caractérisé est celui des calcaires à grandes Lépidocyclines:

Calcaire de Guila-Guila (Cebú, n° 278); il renferme de nombreuses Lépidocyclines de grande taille; les unes présentant des tubercules bien développés sur toute leur surface, ont été rapportées à *L. insulæ-natalis,* tandis que les autres, dépourvues de tubercules ont été assimilées à *L. richthofeni;* ces deux formes sont du reste très voisines; elles sont associées à une troisième espèce beaucoup plus petite, composée d'une partie centrale très renflée bordée par une sorte de collerette: c'est la *L. formosa,* dépourvue de tubercules, mais présentant entre les logettes des cloisons très épaisses. Ces diverses formes se trouvent assez souvent dégagées.

Il faut places au même niveau les calcaires du Barrio de Mesaba (Cebú, n° 272), avec *L. insulæ-natalis,* ceux de la vallée de Cunajumayan (Cebú, n° 28) avec *L. richthofeni* et *L. formosa* et deux qui affleurent près de la mine de Compostela (Cebú, n° 289) avec ces deux mêmes espèces et une troisième voisine de *L. formosa* mais ne présentant entre les logettes que des cloisons minces, c'est *L. inermis.*

3° Il faut placer probablement à un niveau un peu plus élevé, un échantillon de calcaire tendre d'une couleur blanc-crême recueilli dans les grands escarpements, le long de la route de Toledo (Cebú) sur les bords de la rivière Minanga (éch. n° 277, près du Camp n° 1); il présente sur sa surface des échantillons bien conservés d'*Operculina complanata* et de *Cycloclypeus communis;* cet échantillon rappelle les marnes à Silex de l'Aquitanien de Bornéo.

Etage *Burdigalien.*

[28] Cebú Island par Warren D. Smith. *This Journal* (1906), 1, 1043. The Geology of the Compostela Danao Coal Field, par le même, *Ibid. Sec. A,* (1907) 2, 377.

[29] Orbitoïdes von den Philippine, *Centralbl. f. Mineral., Geol. u. Paläon.* (1901), 326.

Ce niveau supérieur est caractérisé par l'apparition des *Miogypsina* et l'abondance des petites Lépidocyclines du groupe de *L.* (*Nephrolepidina*) *verbeeki*. Je lui rapporte les deux échantillons suivants:

Un calcaire sableux jaunâtre, très tendre de Gaba Bay, dans l'île de Batan (éch. n° 8), indiqué comme affleurant bien au dessus du système lignitifère; il renferme des Foraminifères bien conservés, mais très fragiles, parmi lesquels *Globigerina, Cycloclypeus communis, Amphistegina* cf. *mamillata,* et de petits *Miogypsina,* ces derniers rappelant tout à fait les formes du Burdigalien des environs de Dax.

Un calcaire blanc assez tendre, qui couronne la Cordillère centrale de l' île de Cebú, dans la Vallée de Cotabato (éch. n° 279) : il renferme *L. verbeeki,* déjà signalé par M. Warren D. Smith, mais surtout *L.* inflata associé à de nombreuses *Miogypsina irregularis.*

Des trois faunes que je viens de signaler, la seconde caractérisée principalement par l'abondance des grandes Lépidocyclines a une extension considérable depuis Madagascar jusqu'aux Philippines. J'ai fait voir dans mon Etude sur les Foraminifères du Tertiaire de Bornéo [30] qu'elle correspondait à l'Aquitanien; j'y ai distingué trois niveaux E, F, G, qu'il sera peut-être possible de retrouver aux Philippines, quand les explorations géologiques y seront plus avancées.

Le niveau supérieur Burdigalien H, présente aussi une grande extension; il est très développé dans l'île de Nias, à Java, d'où provient le type de *L. verbeeki,* et à Bornéo où je n'avais pas distingué cette espèce de la forme européenne voisine (*L. tournoueri*). Ce même niveau parait se prolonger au Nord à Formosa (Taiwan) et au Japon au environs de Tokyo. Cette dernière localité n'atteint encore que la latitude de 36°, c'est-à-dire à peu près celle de Gibraltar, tandis que les Lépidocyclines atteignent en France presque le 44e degré, et dépassent en Italie le 45e.

Le tableau suivant résume les rapprochements que je viens d'indiquer:

Philippines.			Bornéo.
II.	Calcaires supérieurs à petites Lépidocyclines	Lep. Verbeeki, Miogypsina Cycloclypeus communis	H. Burdigalien.
	Calcaires moyens	Cycloclypeus communis Operculina complanata	G. Aquitanien.
	Calcaires inférieurs à grandes Lépidocyclines	Lep. insulae-natalis Lep. Richthofeni	F. Aquitanien.
		Lep. formosa	E. Aquitanien.
I.	Système lignitifère et calcaire inférieur à Nummulites.	Nummulites Subniasi Amphistigina Niasi Lépidocyclina Smithi	D. Stampien.

[30] *Bull. de la Soc. géol. de France,* 4 Série, t. V, p. 43.

En Europe la succession des faunes est très analogue: les Lépidocyclines y sont très développées dès le Stampien aussi bien en Espagne qu'en Italie, elles y atteignent une grande taille et y sont associées comme à Bornéo avec des Nummulites réticulées. Le groupe du *L. dilatata* remplace le groupe Asiatique du *L. insulæ-natalis* et se prolonge dans l'Aquitanien, tandisque dans les niveaux supérieurs le groupe du *L. tournoueri* remplace celui du *L. verbeeki;* tous les deux sont associées aux *Miogypsina.*

Le bassin européen et le bassin asiatique paraissent avoir été complètement séparés dès la fin de l'Eocène par le soulèvement du Liban qui s'est développé en travers de la Mésogée et a séparé la Méditerranée de l'Océan Indien. C'est seullement à une époque beaucoup plus récente qui l'ouverture de la mer Rouge a été sur le point de rétablir, une communication entre les deux mers, mais les eaux de l'Océan Indien ont été arrêtées à quelques kilomètres de la Méditerranée devant la faible barrière de l'isthme de Suez.

TABLE DES MATIÈRES.

Alveolinella
Amphistegina
andrewsiana (Lepidocyclina)
angularis (Lepidocyclina)
angulosa (Lep. tournoueri var.)
borneënsis (Lep. tournoueri var.)
carteri (Lepidocyclina)
communis (Cycloclypeus)
complanata (Operculina)
Cycloclypeus
ephippioïdes (Lepidocyclina)
Eulepidina
ferreroi (Lepidocyclina)
formosa (Lepidocyclina)
gallienii (Lepidocyclina)
gigantea (Lepidocyclina)
Heterostegina
inermis (Lepidocyclina)
inflata (Lep. tournoueri var.)
inflata (Lepidocyclina)
insulæ-natalis (Lepidocyclina)
irregularis (Miogypsina)
joffrei (Lepidocyclina)
Lepidocyclina
mamillata (Amphistegina)
marginata (Lepidocyclina)
martini Schl. (Lepidocyclina)
martini W. Smith (Lepidocyclina)
martini (Orbitoïdes)
multipartita (Lepidocyclina)
murrayana (Lepidocyclina)
neodispansa (Lepidocyclina)
Nephrolepidina
ngembaki (Lepidocyclina)
niasi (Amphistegina)
Nummulites
Operculina
Orbitolites
Polystomella
provalei (Lepidocyclina)
radiata (Lepidocyclina)
richthofeni (Lepidocyclina)
Rotalia
smithi (Lepidocyclina)
subniasi (Nummulites)
sumatrensis (Lepidocyclina)
tournoueri (Lepidocyclina)
verbeeki (Lepidocyclina)

EXPLICATION DES PLANCHES.

Planche A.

Fig. 1. *Alveolinella.* Old Alpaco Mines (Cebú, N° 273), gr. 10 fois.
2. *Orbitolites.* Même provenance, gr. 10 fois.
3. *Operculina costata* d'Orbigny. Minanga river (Cebú, N° 277), gr. 10 fois.
4. *Operculina costata* var. *tuberculata.* Old Alpaco Mines (Cebú, N° 273) gr. 10 fois.
5. *Cycloclypeus communis* Martin. Minanga River (Cebú, N° 277) gr. 10 fois.
6. *Heterostegina.* Barrio of Mesaba (Cebú, N° 272) gr. 10 fois.
7. *Lepidocyclina insulæ-natalis* J. et Ch. Guila-Guila (Cebú, N° 278) × 10, d'après une préparation de M. Warren D. Smith.

Planche B.

Fig. 1. *Lepidocyclina insulæ-natalis* J. et Ch. Barrio of Mesaba (Cebú, N° 272). (1a) Profil en vraie grandeur; (1b) surface grossie 10 fois; le milieu vers le haut à gauche a été légèrement usé.
2. Même espèce, de la meme localité, grandeur naturelle.
3. *Lepidocyclina insulæ-natalis* J. et Ch. Guila-Guila (Cebú, N° 278). (3 et 3a) En grandeur naturelle; (3b) surface du même échantillon grossie 10 fois.

Planche C.

Fig. 1. *Lepidocyclina richthofeni* Warren D. Smith. Guila-Guila (Cebú, N° 278), grandeur naturelle. (1b) Surface du même échantillon grossie 10 fois.
2. Autre échantillon de la même provenance beaucoup plus épais et avec un commencement de collerette.
3. *Lepidocyclina richthofeni.* Cumajumayan Valley (Cebú, N° 285), détail de la surface, gr. 10 fois.

Planche D.

Fig. 1 et 2. *Lepidocyclina formosa* Schlumberger. Compostela Mine (Cebú, N° 289). Vues de face et de profil en vraie grandeur.
3. Même espèce de Guila-Guila (Cebú, N° 278), détail de la surface gr. 10 fois.
4. Même espèce de la même localité, Section mince gr. 10 fois, d'après une préparation de M. Warren D. Smith.
5. *Lepidocyclina inermis* H. Douvillé. Compostela Mine (Cebú, N° 289) gr. 10 fois.
6 et 7. *Lepidocyclina inflata* Provale. Cotabato Valley (Cebú, N° 289), gr. 10 fois.
8. *Lepidocyclina verbeeki* Newton et Holland. Même provenance, gr. 10 fois.
9 et 10. *Miogypsina irregularis* Michelotti, race *orientalis.* Même provenance, gr. 10 fois.

FIGURES DANS LE TEXTE.

FIG. 1. *Nummulites subniasi* sp. nov. de la formation charbonneuse de l'île de Batan, gr. 10 fois.

2. *Lepidocyclina sumatrensis*, gr. 6 fois d'après la figure originale de Brady.

2bis. Section d'un echantillon de l'île de Nias, gr. 10 fois.

3. *Lepidocyclina carteri* Martin, disposition des piliers près de la surface, gr. 20 fois.

4. *Lepidocyclina gigantea* Martin, disposition des piliers près de la surface, gr. 20 fois.

5. Reproduction grossis 5 fois de la partie centrale de la figure type de MM. Rupert Jones et Chapman, le grossissement de cette dernière figure n'est pas indiqué.

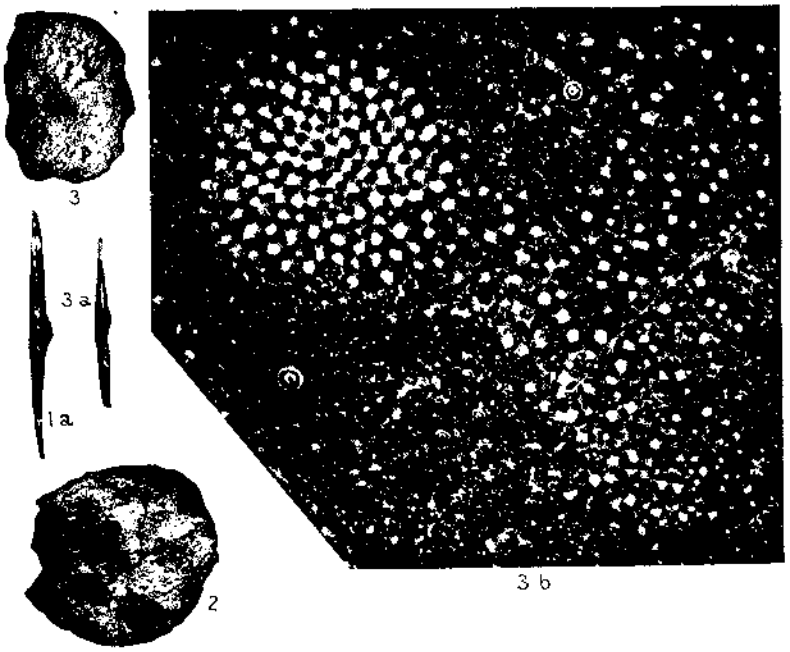
6. *Lepidocyclina formosa*, disposition des logettes sur une section de l'échantillon type de l'espèce, gr. 20 fois.

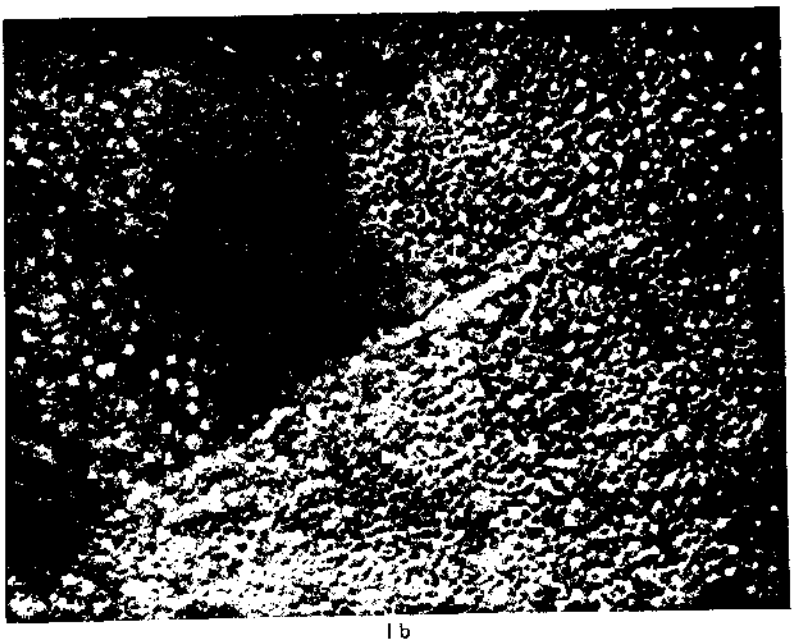
7. *Lepidocyclina gallienii* de Madagascar; coupe près de la surface montrant la disposition des piliers, gr. 20 fois.

8. *Lepidocyclina smithi;* coupe près de la surface parallèle au plan équatorial, montrant le grand développement des quatre piliers médians, gr. 20 fois.

9. *Amphistegina* cf. *mamillata* de l'île de Batan, gr. 20 fois.

PLANCHE A.





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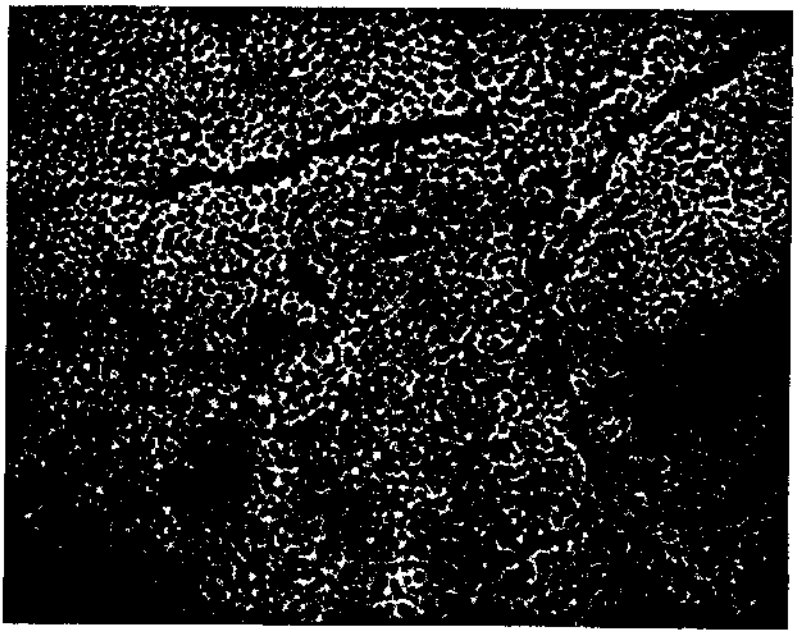

PLANCHE C.

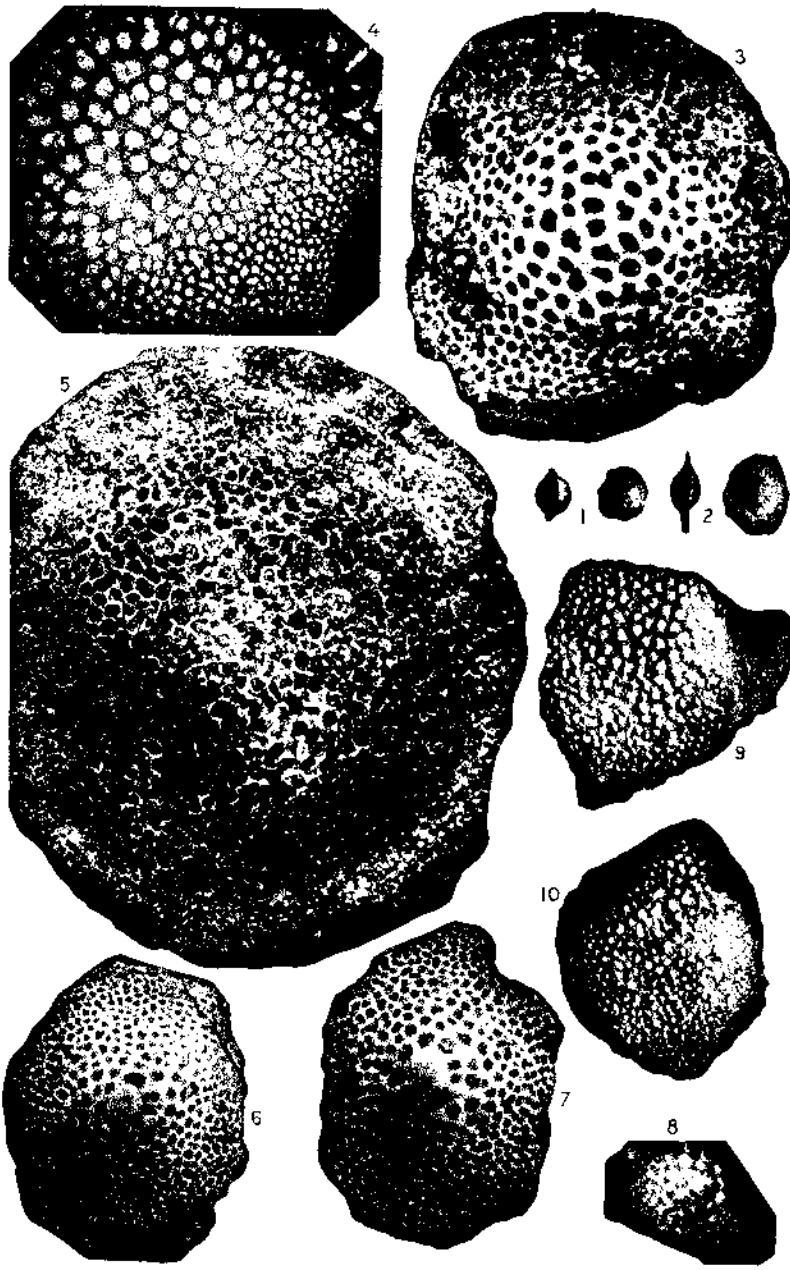

PLANCHE D

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THE HARVEST FEAST OF THE KIANGAN IFUGAO.

By ROY FRANKLIN BARTON.

The Ifugao has some hundreds of spirits of various ranks ranging from gods to demons, monsters, imps, and spirits dwelling in trees and stones; and in addition to these, there are the souls, *linauwa*, of his ancestors, who are nearly as powerful as the other spirits. A very large share of the Ifugao's life is spent in obtaining animals and other things needed for religious feasts.

Whenever a member of the family falls ill, chickens, ducks, pigs, or a carabao, according to the wealth of the family and the seriousness of the case, are killed; one or more jars of rice wine and a quantity of betel nuts and betel leaves are provided. An enormous number of spirits, including all the spirits of the ancestors for six or seven generations, and the ancestral spirits in a direct male line from Bugan and Balitok, the survivors of a great flood, are invited by name to the feast. If an Ifugao leaves on a journey far from home; if he enlists in the Constabulary; or cuts his son's hair for the first time, he makes a religious feast. If he happens to go to Nueva Vizcaya to buy a carabao, he makes a feast to which he invites certain spirits, praying to them to put it into the mind of whomsoever he may try to buy from, to sell the animal cheap. If an Ifugao marries or is divorced; if a child is born to him; if he makes a loom; if he becomes angry with a man of another village and desires his death; if he moves into another house; if he is apparently unsuccessful in a love affair; if he finds that he is consuming his supply of rice too rapidly; if a bird called *pitpit* flies into his house; if he names his baby; if a bad debtor delays payment—a proper feast is the invariable accompaniment.

Certain feasts rank higher in importance, expense, and pretentiousness than others. The most expensive and the one which invests the giver with great prestige is the *uyauc*,[1] the feast of the *kadañgyan*, a class of rich men that approaches an aristocracy. The *kolating*, or harvest feast,

[1] In writing Ifugao words in this article, a phonetic system of spelling is used. It may be noted that the vowels have the Continental values and that the *g* is always hard.

is not very expensive; it can be given for from fifteen to twenty pesos; it is not pretentious, for every one who has a few rice fields gives it; but it is of the greatest importance.[2] When the meaning of rice to the Ifugao is considered, it is not strange that harvest time should be celebrated by feasts having profound religious importance. A bad rice crop indicates that the spirits have a "bad mind" toward the village and special effort must be made to appease them to the end that further disasters may be averted. A good rice crop is an occasion for a thank offering, and for a feast to keep the spirits right during the coming year.

Every man who owns a granary, *alang*, must give a ceremonial feast, *baki*.[3] If his granaries are located in different places, the man must give a feast at each. These have a fourfold function: First, to thank the deities, *bagol*, for the crop of the past year if it has been good, or to reprove them gently and argue the case with them if it has been a bad one; second, to persuade the deities to increase the rice as it is being cut and stored in the granary; third, to induce them not to decrease the rice nor to destroy it during the year, as, for example, by strong winds that can break granaries, or by lightning; and fourth, to put the deities in a "good mind," that they may favor the general welfare of the village during the year to come, that they may make sickness rare, prevent destructive storms, defeat enemies should enemies come, frustrate the designs of sorcerers in other villages, and make women, pigs, and chickens fertile.

The second function of the harvest feast, to persuade the deities to increase the rice as it is being cut and stored, is especially interesting. The idea seems absurd, but it must be considered that these people have no experience contrary to this belief; for, even if they count the *manojos*[4] of rice, *butek*, when they put them in the granary,[5] they do not keep track of the number taken from the granary for daily use. The Igorots of Lepanto also believe that the divinities may increase the rice as it is being cut and stored away. But the most intelligent Ifugaos deny the belief in this form. They believe that the divinities may make

[2] In this paper the writer desires to be understood as speaking of the Ifugaos who live in the village of Kiangan. The customs and practices of the various divisions of the Ifugao tribe vary somewhat and this article would be inaccurate did it pretend to apply to the Ifugaos as a whole.

[3] *Baki* is the general term for a religious feast. All feasts of the Ifugaos have some religious significance.

[4] Small hand sheaves of headed rice. From the Spanish *manojo*, a bundle of herbs or other plants that can be held in the hand.

[5] Counting the *manojos* is, except in the case of a field that is let to a renter, tabooed on the ground that the *bagol* will not miraculously increase the *manojos* if they be counted. There is, among some card players, the vague remnant of a belief that if a hand be not picked up until the deal is finished, the cards will grow to higher denominations.

the rice sufficient, whereas it would not have been sufficient without their action.[6] This, of course, is only a vaguer form, a toning down of the old belief, made necessary by a growing intelligence.

The *kolating* is always celebrated on the day on which the owner of the *alang* begins to cut his rice. In the early morning before either harvest or feast commences, the owner of the fields kills a chicken and examines its gall bladder for an omen as to whether or no the time is propitious for the harvest. A full, black bladder is a favorable sign in this case, as in others in which the gall bladder is examined for an omen, as, for example, in cases of sickness or departure on a journey. Unless the chicken is diseased, the gall bladder is always full early in the morning at which time the digestive organs have for some hours rested from their functions. If, by chance, the gall bladder is white, or empty, the harvest and feast are postponed for two or three days, when the omen is consulted again.

The harvest feast takes place at the granary. The doors of the latter are decorated with leaves of the *haganŋga* tree and with *hagaga*, a kind of grass common in rice fields, similar to what is called "nut-grass" in some parts of the United States. These decorations are said to frustrate malicious human sorcerers and other enemies in their efforts to make the rice disappear rapidly and to decrease it in quantity.

The feast begins at about 10 o'clock in the morning. The *dotal*,[7] a kind of a mat made of long *rumo* stems laid closely parallel and tied together with rattan, used on festive or funeral occasions, is brought from the granary, unrolled, and placed on the ground underneath the structure for the people to sit on. The mat fits the space under the granary. *Bubud* jars, *augang*, generally two, holding from fifteen to thirty liters each, are set in the center of the mat. These jars contain the fermented rice, the malt called *bubud*, and the *binabudan*, or rice wine, called *tapui* in Benguet, and *tafei* in Bontoc. Sometimes the rice wine is termed *binadayan*, but *binadayan* and *baya* are generally terms for intoxicants and apply to the *basi* and gin of the Christian Filipinos and the whisky of the Americans. Usually, there are about four and one-half liters of the beverage in an average-sized *bubud* jar; the rest is malt. Wooden bowls are provided into which the *binabudan* is strained from the *bubud* jars by means of three or four round stalks which hold

[6] There is a feast called *humanŋgali page* given every year by such persons as find the rice in their granaries being consumed more rapidly than they think it should be. Last year, 1909, a partially Christianized Ifugao, one of the municipal officials, refused to give the harvest feast. When, after about three months, he found that his supply of rice was being used up too fast, he gave this feast hoping to mend matters.

[7] *Dotal* is the ordinary Ifugao word for floor. It is applied to the mat here referred to because the mat is used at the feast to make a floor.

the malt back in the jar. The rice wine is dipped up from these wooden bowls by means of coconut shells, *taug*, the rims of which have been notched to fit the mouth. Wooden troughs, *tiñgap*, are filled with betel nuts and betel leaves.[8] In one trough are some twelve to twenty stones called *buga*.[9] Whenever an animal is killed at the granary some of its blood is smeared on each of these stones, the person smearing it saying: "Thou, blood stone, do not get lost."[10] Three or four *palipal*, or bamboo clappers, are placed in the trough with the *buga*. The *palipal* is essentially a partially split stick of bamboo about fifty centimeters long, the halves of which clap sharply together when it is shaken. A large flattish basket of cooked rice, *hinamár*, is provided for the *linauwa*. According to the Ifugao, everything living or dead has an invisible, immaterial shadow, and it is this shadow that the *linauwa* use. After repeated investigations I have been unable to find any term for this shadow. When hard pressed for a name two or three men have called it the *linauwa;* but a *lanauwa*, strictly speaking, is the soul of a man, an animal, or a plant. At any rate, it is a convenient provision of the Ifugao religion that the spirits use the invisible, immaterial, part of the rice wine, betel nuts, blanket, bolo, or other offering, leaving the material part for the consumption or use of the living. After all these things, *bubud*, betel nuts, betel leaves, cooked rice, *palipal*, and blood stones, have been placed in the center of the mat, the people take their places, squatting in a ring about them.

Let us look at the principal actors in the ceremony about to begin. There are twenty men and three women present, this being about the usual ratio of the sexes represented at these feasts, and any number of small boys and girls. The larger children are busy in the rice fields. Occasionally, however, one of the large boys who is carrying rice to the granary remains for a few minutes to watch the ceremonies, and to rest after climbing the steep hillside. A typical feast will be described.

[8] The betel nuts are kept in the troughs from year to year. In some of the prayers of this feast the rice is called on to become hard and dry in imitation of the betel nuts. It is told to "follow" the betel nuts, which stay in the granary from year to year; not to be eaten up; not to disappear, but to have a portion left at the next harvest.

[9] The following is the story of the *buga:* Alingdayu, the place spirit of Nagadañgan, used to eat gold. In his stomach the gold turned to stone. He gave this stone to Balitok, the Ifugao Noah, who, with his sister Bugan, survived a flood that drowned all other people. Alingdayu told Balitok that so long as he kept the stone he would have good crops. Balitok put other stones with this original stone and these others acquired its properties. He gave them to his children and they have added to the number according to the demands of the increased population.

[10] *He'a, buga, adika mondekela.*

The granary belongs to Kodamon, one of the richest men in Kiangan and a typical representative of the upper class Ifugao, the *kadaŋŋyan*.[11] He is tall, well proportioned, and of middle age. He admires the white man and respects him; but his tribal pride, together with a most admirable sense of the fit and harmonious, holds him, it has often seemed to me, true to the religion and life of his fathers. He apes neither the white man nor the Christian Filipino. It is as if he preferred to remain (and this in contrast to certain of his fellow *kadaŋŋyan*) a good Ifugao rather than become a "half-and-half." He knows, as an Ifugao *kadaŋŋyan* ought to know, all his ancestors, male and female, for six or seven generations, and can trace his genealogy in a direct male line to Balitok, the Ifugao Noah. His two sisters and his wife are nearly of his age. They are vigorous appearing women who have worked hard in their time, but now have daughters to take their places in the rice fields. Gimbuŋgan, Kodamon's father, is a very old man, almost blind. No one in the region is better versed in the Ifugao folklore and religion than Gimbuŋgan. His faculties, however, are waning. Whenever he starts an invocation, or phase of ceremony, he goes through it like an automaton, and immediately repeats it again and again until Kodamon starts him off on something else, a task performed respectfully and with evident filial love. Kodamon has carried Gimbuŋgan[12] a distance of over 3 kilometers from Loŋga to Pinduŋgan, where the feast is to be held; for the old man is too feeble to walk so far. Eight or nine middle-aged or elderly cousins, and a pig, complete the list of those who take a leading part in the ceremony.

The younger men[13] play the parts of acolytes and exhorters; they strain the rice wine, hold the cup for the old men who are praying, hand them *palipal* or whatever else may be needed. Not knowing the proper

[11] Padre Juan Villaverde applies the term *nobility* to this class. *This Journal, Sec. A* (1909), 4, 241.

[12] As this is being written, Gimbuŋgan is afflicted with a derangement of the faculties of speech. He has directed Kodamon to find a dog to be killed at a feast; he says that a dog is the proper animal to cure this particular affliction. It may be that he has had a dream to that effect, or it may be that this belief is due to the fact that the dog has more powerful and versatile vocal organs than any other animal known to the Ifugao. Judge the dilemma in which Kodamon finds himself. He would like to obey, it his duty to obey his old father; but for an Ifugao *kadaŋŋyan* to eat dog! It would never be forgotten, and years hence, in the drunken babbling around the *bubud* jar, Kodamon would hear of it!

[13] By younger men I mean the younger middle-aged men, for no youths take part in feasts.

forms and the names of the deities, they exhort and call out phrases of encouragement as the others pray or chant.

Oh! that's it! Oh grant it! Come, ye deities! Take the pig, you deities! Drink the rice wine! Make the rice heavy! Speed the harvesters![11]

These and other phrases the young men call out in a high, falsetto voice as the ceremonies and prayers proceed. Those who perform this office are called *montobal,* exhorters. I have been invited on several occasions to join the young men in this, and on one occasion I accepted; but for an American to summon the *bagol* was, I thought, an unbecoming and, in fact, a sacrilegious levity. However, the people did not regard it as such. In fact, while the people are most sincere in their belief, their religion has not yet reached that stage where ceremonies are conducted with outward tokens of great awe, respect, and solemnity. It is the pig, the betel nuts, the *binadayan,* and cooked rice that the *bagol* want, not praise and long, grave countenances, for the deities are very material in their desires.

The pig, with his feet lashed together, and a small pole passed between them to hinder his struggles, is placed in front of the granary door near the mat. (See Pl. II, fig. 2.)

The drum is the only musical instrument employed at the harvest feast. Sometimes one is used, sometimes two. The drum is played in double time. It accompanies nearly all the ceremonies.

All ceremonial circuits in the harvest feast are counterclockwise, beginning at the east, in front of the door of the granary. The people say that the *bagol* must have told Balitok and Bugan (the man and woman who survived the great flood) to proceed so, and they believe that if a man were to go around in the other direction he would surely fall off a steep cliff in a journey, or else lose his way.

About the middle of the forenoon the people commence to drink rice wine and invoke the *linauwa* of the *monlapu.* So begins the first part of the ceremony.

The monlapu leaders in rice culture.—Dulduli, the mother of Santiago, a rich man of Baai, is the *monlapu* of Kiangan district. That is to say she is the one who decides when each phase of rice culture shall begin, and takes the lead in each. She first begins spading, planting the seed, transplanting, and harvesting. Until she has begun these things, no one else may begin under penalty of misfortune, of bad crops, very likely of death. Dulduli became the *monlapu* in response to a dream that came soon after the death of the former *monlapu.* She is currently believed to have eight years to reign in this capacity, when she will die. When

[11] *Oh hia! Eh damú! Umalikayun bagol! Ialim di babui dakayun bagol! Ambayan di binadayan! Manañyali page! Ikwadim di monagamid!*

she dies, she may inhabit, in the spirit, a tree or a boulder, or she may become a new spring, as did the last *monlapu* in Ligaue. Sometimes the *monlapu* is a man. In case of bad crops the *monlapu* finds himself universally blamed for them. He is considered to have been lax in his religious duties.

As priestess of agriculture Dulduli makes feasts to ask in behalf of the village for rain if it be needed or for relief from a rice pest that may visit it. Just as in life she takes the lead in harvesting, spading, planting, and so on, so after death, she (or he) is the first of all the many spirits to be called to the harvest feast. All the *monlapu* who have ever ruled Kiangan agriculture, together with the *monlapu* of neighboring districts, are called to the feast.

Invocation of ancestors. Monamud.—The invocation and invitation of the souls of the ancestors is, so far as my knowledge goes, the first part of every feast of whatever kind, with the exception of the harvest feast in which the *monlapu* precede. The ancestors are invited to be present and to partake of the feast and drink the rice wine. (See Plate II.) An old man should be able to name his ancestors, both male and female, for at least six generations. Women do not usually know so many, but they call on those whom they do know. Each man invokes his own particular set of ancestors, and if none of his wife's relatives be present, her brothers or her father, he calls upon her ancestors too. In fact, he looks upon his wife's ancestors as his own in a way; and it is his duty to have learned them from her father. Complimentary remarks are addressed to the ancestors, as, for example, this one that I once heard: "Brave ancestor, Ananayo, you who speared the child-slave to death."[15] Spirits of ancestors can not directly affect the harvest nor the growth of rice, but they have the greatest influence with the spirits that do have such power, and with the spirits that bring fortune and misfortune, children, sickness, and death. They must never be slighted nor offended. Their feelings are quite delicate, and if a man neglects his ancestors, they will remove their watchful guardianship from him and misfortune of some sort will result. The prayer to the ancestors is extemporaneous, each man going about it in his own way. The word *sai*, long drawn out, is used in the following invocation:

Thou, ancestor Ginnid, come, drink the intoxicant. There are betel nuts and betel leaves here. Thou, ancestress Bugan, daughter of Oltagon, etc.[16]

[15] *Mahúi Apo Ananayo, te timbuk di himbut ud nate.* Is this a reference to the sacrifice of a slave at some early time?

[16] *Sa-ai-ai-ai umali Apo Ginnid; umalika, uminum di baya. Tehtu momma ut hapid. Sa-ai-ai-ai ka Apo Bugan, nak Oltagon,* etc. In invoking the deities the word *sa-ai-ai-ai* is sung in a peculiar long drawn chant. It does not appear to have any meaning.

Rice wine is consumed at an alarming rate during this ceremony.

Ceremonial killing of chickens.—The invocation to the ancestors finished, some chickens are usually killed. The ceremonial killing of chickens is performed by cutting their throats with a sliver of bamboo. The blood is caught in a vessel and a prayer repeated as the chicken is dying. The chicken is then held over the fire until its feathers are burned off, when it is cut up with a knife or by a sawing motion of the bamboo sliver and put into a pot to boil. The intestines are stripped of their contents by being drawn between the thumb and finger. They are then put on a spit, and broiled before the fire. They are the portion of the cook. Of some twelve harvest feasts which I attended, the bamboo sliver was used at two. At others the knife was used. After the chicken has been killed, the blades of two *runo* stalks are tied in a peculiar manner, and the feet of the chicken stuck into these. Pieces of betel nuts wrapped in betel leaves and stuck on little sticks are tied in the blades. The *runo* stalks, so adorned and called *paghing*, are placed one on each side of the gate of the fence surrounding the granaries, or in the fence in front of the granary door. They are given to the *pili*, the spirit that guards the granary against thieves.

The invocation of the ancestors proceeds in a rather leisurely manner, and it is generally noon or even later when it is finished. The chickens that have been killed and cooked are not eaten, but are put in a wide, flat basket as an offering to the spirits that come to the feast. In fact the party has not eaten anything since the night of the previous day and continues to fast until the ceremonies are finished.

The Ifugao conception of the universe.—In order to make what follows intelligible, it is necessary to explain the universe according to the Ifugao's idea. The Ifugao conceives of three worlds: the Sky World, the Earth World, and the Under World. Each is populated by a variety of spirits, which live in groups of houses, in trees, gullies, springs, waterfalls, currents, stones, and houses made of skulls. There they abide much as mortals do. They have an insatiable appetite for pig meat, betel nuts, and wines; some of them at least need bolos, blankets, beads, and other things that man uses. In addition to the three worlds mentioned before, there are two regions, places where the three worlds meet: The East, *Lagod*, and the West, *Daya*. In the East live some very vicious place-spirits. The spirits in the East are much more numerous than those in the West. The Kiangan Ifugaos say that they themselves came from the East, which probably accounts for the fact that the East is more thickly populated with spirits. There is no northern nor southern region thus populated.[17] In fact, there are no words

[17] Villaverde is in error when he states that *Kadunĝayan*, the place where souls of those who die a natural death live, is to the north. *This Journal, Sec. A* (1909), 4, 248. *Kadunĝayan* is in the East.

in the language for north and south. If a Kiangan man wishes to say north, he names some remote place toward the north, as *ud Banawul*, toward Banaue, a village in a northerly direction from Kiangan.

Invocation of the makalun. *Monmakalun.*—The *makalun*,[19] the spirits that make men forget, that remind or suggest to them, are next invoked. The *makalun* may work a man great injury by causing him to forget the debts that are owed him, to lose spear or bolo, and so on. "The *makalun* are like police, also," say the Ifugaos, "they bring other spirits to the feast." This simile is perfectly clear when it is understood that a very small part of the work of an Ifugao policeman consists in preserving the peace, and that by far the greater part of his work consists in calling *cabecillas*[19] and *kadañgyan* for consultation; in carrying instructions to foremen on the trails; carrying the mails and the like. The *makalun* are messengers of the other spirits and of those men who know how to call on them in the right way. As it was explained to me, the *makalun*, when sent to call spirits to a feast, notify the chief spirit in each of the various villages of spirits. This chief spirit notifies the others that such and such an Ifugao is making a harvest feast, and that such and such spirits may go to it. An old man told me that the *makalun* tells the chief or *cabecilla* of the spirits something like this:

> The men are harvesting. Let us go to the granary of Kadamon and Gagaya. We will drink rice wine. They will give us their pigs, chickens, and rice. We will chew betel nuts.[20]

Some of the *makalun* most frequently invoked are: Ud Lagod (in the East) Tayaban,[21] nak Balud;[22] Tayaban, nak Tagudan; Tayaban, nak Manguli. Ud Kabunian (in the Sky World) Tayaban, nak Dalogdogan; Tayaban, nak Balitian; Tayaban, nak Amkidul; Bugan, nak Numbian; Bugan, nak Balitian; Bugan, nak Abugai. Ud Dalom (in the Under World) Tayaban, nak Ginita; Tayaban, nak Bahinag; Tayaban, nak Litnak. The number of *makalun* and the list of spirits that may be called upon to serve as *makalun*, varies considerably at different feasts. This is the most variable, and in fact the only greatly variable, feature of the harvest feast as performed in Kiangan villages.

[19] *Makalun: ma*, able; *kal*, word, speech; *makalun*, one who is able to tell or to summon.

[19] Spanish word used in the Philippines in the sense of chief.

[20] *Mon-ani di Ipuwao. Ume-tako hi kalumaga di Kodamon ya*
Are agents of harvesting the human beings. Will-go-we the granary of Kodamon and
Gagaya; Mañginum-tako baya. Idat-tako babui, ya manok ya pige-da.
Gagaya; Will-be-agents-of-drinking-wine. Will give us the pig, the chickens, the rice-their.
Monmomma-tako.
Will-be-agents-of-chewing-betel-we.

[21] *Tayaban.* See under heading "The Tayabans" of this article.

[22] *Nak*, son of.

The people call the *makalun* thus, drinking quantities of rice wine at the same time:

Come thou, Tayaban, the Messenger Deity, son of * * *. Notify the souls of our ancestors to come. Notify the Deities of the Sky World, of the Under World, of the East, of the West, to come. Notify our relatives and our companions. Summon Banuyuk of Panuyu. In order to speed the harvesters of the rice; in order to multiply the bundles of the rice. There are rice wine and betel nuts and betel leaves here.[23]

These and similar phrases are repeated over and over, the fervor of the feasters growing the while.

Suddenly some of the feasters, perhaps three or four, perhaps a dozen, are seized upon and possessed by an equal number of *makalun*. Through these human agencies, the *makalun* chant:

We will call your relatives and companions and the spirits of the Under World, of the Sky World, of the East, and of the West, because you are making a harvest feast.[24]

So ends the second ceremony of the feast, the *makalun* leaving the bodies of those whom they have possessed and starting off on their errand immediately.

The earth gods and the sky gods.—These deites, of all those whom the Ifugao calls to the harvest feast, are the only ones of sufficient dignity to be termed gods. Their benevolence generally exceeds their malice, which is not true of the other deities; and they control some of the forces of nature.[25] Bahiwag and his brothers, Dumuan and Timukul live in the Under World. They are thought to have a great deal to do with the growth of plants, especially with germination. Dalogdogan, Balitian, and Bayuhibis live in the Sky World and control the weather. Balitian makes rain and Bayuhibis makes mist. They are brothers of

[23] *Sa-a-a-i Umalika Tayaban an Makalun, nak * * *. Kalunum di linauea di amud ta umalida. Kalunum di bagol ud Kabunian, ud Dalom, ud Lagod, ud Daya, ta umalida. Kalunum di mundomang*[a] *ya nunhalug. Panunduan hi Banuyuk ud Panuyu. Ta ikuadin di monagamid di page; ta gumalutigid di udung*[b] *di page. Tehtu baya ya momma ya hapid.*

[24] *Sa-a-a-i* Say! *Komalum-kami* Will-be-agents-of-calling-we *mundomang,*[c] relatives *munhalung* companions *Idalom*[d] Residents-of-the Under-World

Ikabunian Residents-of-the Sky-World *Ilagod* Residents-of-the East. *Ipaádan*[e] Residents of the West *te mon-kalating-kayo.* because agents-of-performing-harvest-feast-you.

[a] *Mundomang:* relatives, including relatives by blood and relatives by marriage.

[b] *Udung,* butt of the *manojo* of rice; poetically, the whole *manojo.*

[c] *Mundomang:* See note *a.*

[d] *I,* as a prefix in the Kiangan dialect, denotes residents of; as, for example, *Ikiangan,* residents of Kiangan; *Idalom,* residents of Dalom, the Under World.

[e] *Paádan,* a place to the west; figurative term for West.

[25] Another quality of their godhood is that so far as any Ifugao knows, they have always existed. They were not born of parents. There is no story of their creation so far as I have been able to ascertain.

Amkidul and Bagilat, who respectively make thunder and lightning. These gods are the same throughout Ifugao-land, notwithstanding the fact that there are ten or twelve different dialects in the subprovince. They are invoked by the entire body of feasters, in the usual high, falsetto voice, in these or similar phrases:

Oh come! Bahiwag of the Under World. Drink the rice wine. Take the pig. Speed the harvesters of rice. Oh! that's it! Bagol! Make the rice grains as numerous as the sands. Miraculously increase the rice! Oh! Grant it! Come thou! Make the rice heads hang over (with weight). Oh! that's it![26]

The gods are called separately and in groups. Suddenly one of the gods (Bahiwag[27] always comes first) comes and possesses a feaster. The latter springs up, seemingly without premeditation, seizes a dish of rice wine, or, it may be, one of the big *bubud* jars, swings it with a circular motion under the granary, at the same time hopping with the characteristic Ifugao dance steps. The cries and calls of the feasters and their white-heat fervor leave no doubt that here is a religion the letter of which has not yet superseded its spirit. The one possessed drinks and gives the others to drink, chanting the while:

I come up from below, I, Bahiwag. I behold with favor that you are making a rice feast. I dance, and I drink the rice wine. Drink, you participants; because I am giving you to drink. I taste the chicken, the pig, and the rice, as I have been accustomed to do in times past. Thus I drink in dwelling and granary. I desire it so year after year.[28]

The one possessed passes to the front of the granary where he executes a little dance. Another feaster, of either sex, who has been possessed by Tinukud, one of the other two spirits from the Under World, quickly follows him, and together they dance and chant:

We are the miraculous increase of the rice. We are the slowness of the rice to be used up. We are harvest-knives and ties.[29]

[26] *Sai! Umali Bahiwag ud Dalom. Añgbayam di binadayan. Ialim di babui, Ikwadim di monagamid. Oh-h-h hia! an Bagol! Pumantal di Biñga. Humañgali page. Eh-h-h Damú! Umalika. Lumatok di bintok. Oh-h-h hia!*

[27] Bahiwag is chief of the gods of the Lower World. Dalogdogan is chief in the Sky World. [There seems to be some doubt as to whether these two gods are considered as leaders in any sense. EDITOR.]

[28] *Sa-ai-ai-ai! Limadañgak hi* (Came up I) *Bahiwag ud Daud.* (Bahiwag of Below.) *Belibeliokak* (Object-of-sight-mine) *Kolotinggyo* (Making-harvest-feast-your)

Kadayaowak ya angbayak di binadayan. (Gift-mine and drink-I the intoxicant.) *Tinulpangkayo baliknadan te impiñgak* (Drink-ye participants because)

matoldadawak hi manok ya babui ya page-yo (give-taste-I the chickens and pigs and rice-your) *te impainghak di kakohayan.* (has been habit-mine in the time-past.)

Mobanum tinulpang i haldon ya kalumaga. Pudhok at hitu katáwotáwan. (Thus (?) drink (in) the dwelling and (in the) granary like-I so yearly.)

[29] *Tanglé-kami. Gikud-kami. Gipan-kami, binuyu.*

The second feaster takes the dish of wine from the first and offers it to him. He bends and drinks a long draught and then returns to his place on the mat, spewing out the last sup of rice wine on the ground. (See Pl. III, fig. 1.) The second performer now executes some fancy steps and chants. He is joined by a third who, after the usual little dance, relieves his companion of the dish of wine and holds it out at the level of his waist for the ceremonial drinking. And so it goes until the drinking has been repeated six times, that is, once for each god.[30]

There follows a recess in which the participants relax from the high-wrought and heated fervor in which they find themselves at the end of this ceremony. They sing work songs and songs of amusement. At about this stage of the feast, too, the drunkenness has usually proceeded far enough for the inevitable boasting about wealth and fields to begin. "An Ifugao's prestige among his fellows is fixed by the number of rice fields, of gold neck-ornaments, and agate beads, *pañgo*, he has, by the number of feasts he gives, and the number and kind of animals he has killed at these feasts. These facts determine the trend that the drunken babbling usually takes. Rare, indeed, are the recesses between ceremonies, from this point on, when some particularly poor relative does not amuse the company with a recital of his enormous wealth and of the feasts he is going to give.

The anointing. Monlana.—These gods, a lower order of beings than the preceding, and more to be feared, as they belong to an order more malicious, now demand attention. Asked if these spirits are bad, the people say: "Yes, bad; but also good, if treated well." The people say that these spirits steal the life of the rice if the customary offerings and respects are not paid them at harvest time and that they may even diminish the rice in the granary; but if coaxed and cajoled in the proper form, they "bring the life of the rice," and even increase it during harvest and after it has been stored in the granary.[31] They are invoked

[30] In the feast of Kodamon and Gagaya, the actors were four men and two women.

[31] The old men are very argumentative in their invocations to these and other malicious spirits. They try to convince them of the error of maliciousness directed toward those who treat them well. The following is one argument: "If you do evil to those who give you feasts, of what use is it to offer these feasts? Soon no one will kill pigs for you, or give you betel nuts; because you prey upon your friends as well as upon those who neglect you." The following spirits are usually called on, although the list is slightly varied by additions, there being a legion of less important spirits of the same class: Lukbukan of Binuyuk;[a] Alingdayu of Nagadangan,[a] Mongahid of Nantogan;[a] Binongbong of Lantogan;[a] Humidhid of Ilayap;[a] Dinkom of Imaloi;[a] Balud, nak Dinkom of Nuayan;[a] Tugadan of Ibaya;[a] Intikap of Kahilauan;[a] Inudoman of * * *.

[a] Names of places a few miles east or northeast of Kiangan.

by phrases similar to those used in calling the gods in the foregoing ceremony. A bowl containing chicken grease is passed about by a feaster, possessed by Tayaban, son of Mongáhid, who dances and chants as he goes. As he passes each head, he dips his finger in the grease and anoints the head of each person who is taking part. The feasters shout:

We put oil on our heads, in order to put oil on the heads of the harvesters of the rice, in order to make the rice increase.[32]

The people can not explain this custom of anointing, nor the chant that accompanies it. They only say, "That is the right way to perform a harvest feast." The following explanation is favored by certain evidence, and presented to the reader for what it may be worth. It is to be noted that all these spirits are place-spirits, and that their residence, Binuyuk, Nagadaŋgan, Nantogan, etc., are all places in the East, which, according to the Kiangan Ifugaos, is the cradle of their tribe. Now when an Ifugao makes a new rice-field, he always performs a ceremonial feast called *laŋyalang*, killing some chickens to appease the spirit who resides in the locality. Otherwise, the place-spirit would make all sick who disputed dominion with him and disturbed his peace by working his land. He would cause the field to be washed away, the rats to eat the young rice-plants; in short, he would make the field an utter failure. It may be that in times past this ceremony was performed annually, whenever the land was worked or whenever the crop was harvested; that the workers marked themselves with fat of the sacrificed chickens in order that the place-spirit might know those who had made the proper sacrifice; that the custom still survives in the harvest feast; and that the feasters, as they say, anoint themselves "in order to put oil on the heads of the harvesters." The custom, so explained, has points in common with the Hebrew Passover. Like the angel of the Lord, these terrible spirits "pass over" those who present evidence of having complied with the requirements.[33] These faithful ones the spirits do not make sick nor punish by stealing the life of the rice. If, as the Kiangan Ifugao says, these spirits come from the East, it is to be noted that they still pay homage to the place-spirits of their former habitat; and, hallowed by time, they now rank little lower than gods.

[32] *Monbelabela-kami ta monbelabela di monagamid di page,*
We-put-oil-on-our-heads in-order-to put-oil-on-the-heads of-the harvesters of the rice
ta gumikud
in-order-to-make-the-rice-increase.

[33] The meaning of white chicken feathers worn in the hair, now purely ornamental, at first may have been a demonstration to the spirits that the wearer had made the proper sacrifice.

After the foregoing ceremony, and in preparation for the succeeding one, an old man anoints the bamboo shakers, saying:

I anoint the *palipal* in order to do the same to the rice; to make soft and tough the rice (straw) in the fields;[34] to speed the harvesters; to multiply the bundles of rice in the fields in order that the harvest may be great; in order that the rice heads may hang down;[35] so that the harvest will be heavy; in order that the empty space in the granary may be filled with plenty.[36]

The tayaban. Monligid. (Procession with shakers.)—The *tayaban* are predatory spirits almost without redeeming qualities. They are able, it is said, to increase the rice, "because they are divinities;" but this is through analogy with the place-spirits, and the gods of the Sky and Under Worlds. As a matter of fact, not much is expected of them except neutrality. If this nuetrality is not secured, they steal "the life of the rice;" they decrease it after it is stored in the granary; they fly in the night, hunting *linauwa,* souls that have wandered off in dreams;[37] they kill the fœtuses of pregnant women. Tayaban hi Apolili, is the genius of landslides. The *tayaban* that are called to the rice feast are Tayaban, nak Lukbuban; Oltagon, his sister; Tayaban, nak Alingdayu; Tayaban, nak Binongbong; Indagan, his sister; Tayaban, nak Mongahid; Tayaban Kawángwángan;[38] Tayaban, nak Humidhid; Tayaban, nak Tugadan; Tayaban, nak Mañguli; Tayaban, hi Duyug;[39] Tayaban, nak Dinkom; Tayaban, nak Balud; Tayaban Inudoman.

The *tayaban* are summoned orally in much the same manner as the spirits in the two foregoing ceremonies. They are asked to increase the rice, multiply the grains and bundles and make them heavy, "In the hope," said an old man, "that they will hear what the other spirits do, and do likewise through shame." When the *tayaban* come, they take possession of the feasters, by twos, usually a man and a woman, the man first. The *tayaban* then cause them to take *palipal*,[40] bamboo clappers,

[34] So that it will not fall down, and the grain be scattered and lost.

[35] From weight.

[36] *Ilana-ak hi palipal ta ukulan di page; humayumut ya pomatlag indaluñgene; ta ikwadin di monagamid; ta gumalutigid udung nan indaluñgene hi bananu, ta dakol ni ánian; lumatuk di bintok ta dakol di ánian, ta inhigup natdañgan di hinumpkal.*

[37] They carry away and imprison the *linauwa*, thus causing the person whose *linauwa* was stolen to languish and die. The body without a *linauwa* is like a palm tree without a bud.

[38] *Kawangwangan;* of the streams. *Wangwang*, a stream; *ka*, a prefix of abstraction and denoting extension.

[39] Tayaban hi Duyug. *Tayaban* of the *baliti* tree.

[40] Mr. H. Otley Beyer, of the division of ethnology, Bureau of Science, tells me that in Banaue, if a feaster breaks a *palipal*, he must make an expensive feast to ward off misfortune, and is tabooed from taking part in any other harvest feast until the next year. This is probably the case in Kiangan also.

and with the characteristic Ifugao ceremonial steps, proceed around the granary, or if there be, as there usually is, more than one granary in the inclosure, to proceed around all of them. (See Pl. III, fig. 2.) At each of the four corners, the *palipal* is outstretched toward the sky and sharply clapped. (See Pl. IV, fig. 1.) While this procession is passing the feasters are fervently calling on the *tayaban* in high falsetto voices, and telling them what is desired. They say:

"Do not travel through our houses and our granaries and our villages. Fly over them. Do not frequent our fields nor our forests nor our roads. Fly around them. Harass our enemies. Do not diminish our rice. Increase it." And so on.

As the actors complete the circuit, a feaster with a cup of wine in his hand executes a little dance before the pig and pours on it a little rice wine, saying at the same time, "Get the pig, you spirits."[41] After the wine has been poured on, he says: "Oh, that's it! A libation has been made the spirits!"[42] This circuit is performed four or six times. Usually the first actor is relieved by others. At the completion of each circuit, wine is poured on the pig.

Coming of Buluhan, Monbuluhan.—After a recess Buluhan, nak Lukbuban of Binuyuk,[43] is called. Buluhan is conceived of as an enormous creeping being, like a snake. He is called on in the usual phrases to come and partake of the feast and to increase the rice. Finally, he comes and possesses a feaster. The one so possessed takes a piece of betel nut in his mouth and a betel leaf. With these between his teeth, the leaf projecting like a snake's forked tongue, he squirms and wriggles over the rice that is stacked under the eaves of one side of the granary (for no rice is put into the granary until after the feast) in imitation of the creeping of a snake. He chants:

I have come from the East, I, Buluhan, son of Lukbuban, who live in Binuyuk. I give (what you ask). I increase the rice. I drink the rice wine, as I have been accustomed to in time past.[44]

The feaster wriggles to a bowl of *hubud,* rears his head and gazes at the pig. At the same time, another feaster pours rice wine on the betel nut from his mouth and drinks from the dish.

[41] *Ialim di baboi dakayun bagol.*

[42] *O hia! Nagilig an bagol.*

[43] Binuyuk, a place in the East.

[44] *Himungduak*[a] *hi Buluhan, nak Lukbuban Ibinuyuk,*[b] *kadayaowak ta humanĩgale page. Angbayak di binadayan ta impayinhuk di kakohayan.*

[a] Himungdu, come from the East. Humabang, come from the West. Lumadang, come from the underworld. Numudnud, come down from the Sky World. These words are used only in religious ceremonies.

[b] Ibinuyuk, residents of Binuyuk.

Bugan.—Bugan, nak Pundakugan, is the owner of all the locusts. "Locusts," say the Ifugaos, "are her chickens." A woman takes betel nuts and betel leaves, with some malt,[45] *bubud,* in a wooden bowl, and dances in front of the granary, one hand upraised. She waves her hand, saying: "Bugan of Binuyuk, daughter of Pundakugan, betel nuts, betel leaves."[46]

The feasters invite Bugan with loud cries, and the old men pray to her and argue with her against the folly of injuring her friends. The argument may run:

> Turn your grasshoppers on the fields of our enemies, or of those who do not give you the things you want, and do not injure us, your friends, who give you rice wine, betel nuts, and pig.

As the woman dances, a libation is poured on the pig. Bugan nak Humanun tells her husband to go at night to steal the life of the rice of those toward whom she is spiteful. She is invited to the feast by the same ceremony as that observed in inviting Bugan Pundakugan.

The wind deities. The púok.[47]—The *púok* are possessed of considerable power over the forces of nature; they control the strong winds, the winds that come with typhoons; they can increase the rice during harvest time; they can steal its life away and cause it to languish and die before maturity. It is a very noteworthy fact that in the religion of the Ifugao there is no clearly defined division of labor between the spirits or classes of spirits. Thus, the place spirits, the *bugan,* the *púok,* and even the *tayaban,* are besought to increase the harvest, although the *púok* are primarily controllers of the strong winds and the *tayaban* are predatory spirits. The wind deities usually invoked are four: Dinipáan of Paádan;[48] Púok of Halamban;[49] Púok of Ambatu;[50] Púok of the East.

The distinction between the *púok* of Halamban and the *púok* of Ambatu is that strong winds caused by the former are not accompanied by rain, while strong winds caused by the latter are so accompanied.

The feasters invite the *púok* in the usual terms and call upon them to increase the rice. The special phrases of the invocation of these spirits are:

[45] The Ifugao not only drink rice wine, but eat its malt.
[46] Bugan ud Binuyuk, nak Pundakugan bibihalag daŋgaidahan.
[47] *Púok:* a strong wind.
[48] Paádan, a place about three miles west of Kiangan.
[49] Halamban, a place toward the south.
[50] Ambatu, a place toward the south.

Rice wind, wave the rice in the fields, but return its soul (life?). Make healthy its soul. Do not fell the houses and granaries. Do not summon the rains because we are harvesting. Here, you have rice wine and pig, etc.[51]

A feaster is possessed. He takes a basket containing betel nuts and betel leaves, malt, and a coconut shell containing rice wine, and with a *palipal* in hand proceeds swiftly[52] about the granary, with the Ifugao ceremonial steps, rattling the bamboo clapper vigorously[53] at the four corners of the granaries and chanting as he goes:

We are the slowness of rice to be used up. We are the miraculous increase of the rice. We are the life of the rice. We are the harvest knives.

This procession is repeated four times, once for each *púok*. At the termination of each circuit, rice wine is poured on the pig, the person pouring it crying: "A libation has been made unto all you *púok*."[54] Usually the circuit is performed by a different actor each time. (See Pl. IV, fig. 2.)

The bakayauan. Monbakayauan.—The *bakayauan* are powerful deities that go armed with spears. They are hunting spirits. Some of them have dogs. They are offered sacrifices by hunters, and go to the chase with them. Most of them live in the Sky World, some in the Under World, and others have special places in the East.[55]

The feasters begin calling *bakayauan* to the feast. Suddenly one of their number springs up, seizes a spear[56] from those stuck in the ground

[51] *Pumpúok hi page, inumyum di page, mu ibangad di linauwa-na. Adikayo tiwan di hataon ya kalumaga. Adikayo ayagan di udan te monaki-kami. Tehtu binabudan ya babui, etc.*

[52] Note the connection in the Ifugao's mind between the passage of the wind over the rice and its health and growth.

[53] Note that the manner in which this procession is made is symbolic of a strong wind.

[54] *Nagitig dakayun púok, amin.*

[55] These deities are: Bakayauan, nak Panuya, Kabunian; Bakayauan, nak Balitian, Kabunian; Bakayauan hi Tayaban, Kabunian; Bakayauan, nak Holdayan, Kabunian; Bakayauan, nak Mañgamalig, Kabunian; Bakayauan, nak Balitok, Itapugan; Bakayauan, nak Lauan, Dukligan; Bakayauan, nak Dinlugan ud Dulom; Bakayauan, nak Domagaan, Kabunian; Bakayauan, nak Lakmayan, Kabunian; Bakayauan, nak Buluhan, Kabunian; Bakayauan, nak Angunagub, Kabunian.

[56] The spear must be a bright handsome one, of the class called *bolobog*, or of that termed *gayang*. This latter is called by Jenks the "anito spear." At one feast I witnessed in a small group of houses no handsome spear of either of these two classes could be found. The procession about the granary was omitted.

near by, dances before the door and then proceeds around the granary. Holding the weapon in both hands, he brandishes it with an upward and downward wave-like motion as he goes. His black eyes shine; he has the appearance and glance of a madman. He chants:

Harass (or, bewitch; torture) the enemies, and the rice disease, and the sorcerers (those who do evil through their bad ceremonies) and the pests.[57]

The feasters cry out in the same and similar phrases and with the ever present prayer that the spirits increase the rice. The procession is repeated two, four, six, or eight times. At the end of each procession the actor executes a little dance before the pig, and after two or three threatening gestures throws the spear across the pig, sticking it in the ground a meter or so beyond. The spear is thrown from a distance of three to five meters as near as possible to the pig without injuring him. At the same time rice wine is poured on the pig, accompanied by the usual phrases. (See Pl. V, fig. 2.)

The Koliaban, or Coverer.[58] *Monkoliaban.*—A blanket dance is the ceremony of this spirit. (See Pl. VI, fig. 1.) The dancer is believed to be possessed. The dance is very graceful, and resembles one I have seen performed by Bagnen and Besao Igorots in Lepanto. The people invite and beseech the *koliaban* in the usual terms and in addition make the following plea:

Cover up (smother) thou the lack of rice, the hungry time, the rice disease,[59] and the pest; but do not cover up the chickens, the pigs, and the rice. Cover up thou the sorcerers, the persons who do evil through bad feasts, and the persons who cause pests.[60]

Ceremonial killing of the pig. Monwiwik.—The pole is removed from between the legs of the pig, which is then turned with its head to the east, for pigs are usually ceremonially killed facing the east. One man holds the legs so that the animal can not struggle; the person who is acting as cook cuts through the skin just below the sternum and pushes into the chest of the helpless animal a *runo* stalk, *wiwik*, about a foot

[57] *Hañgo hañgonmo hai binuhul utyai hiba utyai mangidat utyai balanday.* This is probably only a fragment of what he chants. It is all I have obtained as yet.

[58] Cf. the *Sa-rukub rang buni* of the Malays. The World Coverer, Malay Magic, p. 94.

[59] The disease of the rice, not the sickness caused by the new rice as described by Jenks. The Bontok Igorot, *Ethnological Survey Publications*. Manila (1905) 1, 107.

[60] *Koliaban-mo hai bitel, hai duian, hai hiba ya hai balangdan; mu adim koliaban hai manok utyai babui utyai page. Koliabanmo hai mañgidut, hai manongdong, utyai mondayapat.*

long. This he thrusts into the animal's lungs, the while it squeals piteously. Generally it takes some time to kill the poor animal, as the stick is usually too blunt to puncture the walls of the heart or other large blood vessel, and the animal dies from hæmorrhage into the lungs. (See Pl. VI, fig. 2.) While the pig is being killed the old men pray most fervently.

Burning the hair off the pig. Monlagim.—The hole in the pig's breast is plugged with a piece of *runo* and the animal is held in the fire, or laid in the fire until the hair and epidermis are charred. The body is then scraped. Needless to say, the animal is much bloated by the heat. (See Pl. VII, fig. 1.)

The Lepanto Igorots go through the same procedure with the pigs and dogs that they kill.

Dispatching the spirit of the pig. Monhu-aa.—After the pig has been scraped, a wreath is made of the stick of *runo* with which it was killed, two or three heads of rice, and a spray of *hagaga* grass. (See Pl. VII, fig. 2.) The pig is placed in the center of the mat, and decorated with the wreath. The feasters gather about, and, grave and silent, sit down while an old priest charges the pig's soul as follows:

Thou art enwreathed, pig, because thou art a young pig that wast used at a harvest feast; (and) in order that ye all, rice, hagaga, death stick (wiwik, the stick used to kill the pig) and pig, may go in company. Rise ye all unto the Sky World. Arrive unto the quarters of Ampúal, Balitian, Humamu, Wigan, Bayuhibis, Dulayan, Humok, Dakwigan, Numbian, Baluog, Amgaliñgan, Bañganan, Intoldaon, Umbumabaka. Tell them, pig, that the men killed thee; that they sacrificed thee. Say thou, pig, "I was sacrificed at a harvest feast." Tell the *bagol* to increase the rice, to make the rice heavy, in order that the empty space in the granary may be filled with plenty. Do not remain speechless. Do not tarry, sleeping, pig.

Thou art enwreathed, pig, because thou art a young pig that wast used at a harvest feast; (and) in order that ye all, rice, hagaga, death stick and pig may go in company. Descend ye all unto the Lower World. Arrive unto the quarters of Bahiwag, Tinukud, Dunuan, Kaliog, Lutwag, Ginita, Humamu. Tell them, pig, that the men killed thee, that they sacrificed thee. Say thou, pig: "I was sacrificed at a harvest feast." Tell the bagol to make the rice heavy in order that the empty space in the granary may be filled with plenty. Do not remain speechless. Do not tarry, sleeping, pig.

Thou art enwreathed, pig, because thou art a young pig that wast used at a harvest feast; (and) in order that ye all, rice, hagaga, death stick, and pig, may go in company. Proceed ye unto the East. Arrive unto the quarters of Lukbuban, Binongbong, Alingdayu, Mongahid, Balud, Tugadan, Mañgali, Panikdapan, Púok, Nabalud, Dinumpitan, Binudbud. Tell them, pig, that the men killed thee, etc.

Thou art enwreathed, pig, because thou art a young pig that wast used at a harvest feast; (and) in order that ye all, rice, hagaga, death stick, and pig, may go in company. Proceed ye unto Pañdan (the West). Arrive unto the

quarters of Kabigat, Dinipáan, Dumugung, Nalipang, Ambatugan. Tell them, pig, that the men killed thee, etc.[61]

The cutting up of the pig.—The small boys, who have listened patiently during this rather lengthy prayer, now have their reward. While the greater part of the animal is eaten at the granary by the feasters and

[61] Wagáhan daka babui te kinlum daka, te impañga daka page, ta monkakuyug-kayon page, hagaga, wiwik, ya babui. Tumalakdang-kayo kabunian. Dutnangyo hudok nan Ampúal, hi Balitian, hi Humamu, hi Wigan, hi Bayuhibis, hi Dulayan, hi Humok, hi Dakwigan, hi Numbian, hi Baluog, hi Amgalingan, hi Bañganan, hi Intoldaon, hi Umbuma-baka. Imbagadaka babui dimatayanda he'a; nañgipadúanda babui ke he'a. Humapitka babui 'Impaduyu-ak hi kolating.' Komali din bagol ta gumikud di page, ta humañgale page, ta ihigup natdañgan di hinumpkal. Adika mahduman. Ugikabo maginaginluk babui.

Wagahan daka babui te kinlum daka, te impañgadaka page ta monkakuyug-kayo page, hagaga, wiwik ya babui. Monudnud-kayo ud Dalom. Dutnangyo Bahiwag, hi Tinukud, hi Dumnan, hi Lutnak, hi Kaliog, hi Ginitu, hi Humamu. Imbagadaka babui dimatayanda he'a, nañgipadúanda, babui, ke he'a. Humapitka, babui 'Impaduyu-ak hi kolating.' Komali din bagol ta gumikud di page, ta humañgale page ta ihigup di natdañgan di hinumpkal. Adika mahduman. Ugikabo maginaginluk, babui.

Wagahan daka babui ta kinlum daka, te impañgadaka page, ta monkakuyug-kayo page, hagaga, wi-wik ya babui. Monuhaal ud Lagod. Dutnangyo Lukbuban, hi Binongbong, Alingdayu, Mongahid, Balud, Tugadan, Mañgali, Panikdapan, Púok, Nabalud, Dinumpitan, Binudbud. Imbagadaka babui, di matayanda ke he'a, etc.

Wagahan daka babui te kinlum daka, te impañgadaka page, ta monkakuyug-kayo page, hagaga, wi-wik ya babui. Monuhaal ud Paádan. Dutnangyo Kabigat, hi Dinipáan, hi Dumugung, hi Nalipang, hi Ambatugan. Imbagadaka babui dimatayanda ke he'a, etc.

The following is the first section of the above invocation:

Wagahan *daka'n* *babui* *te* *kinlum* *daka* *te*
Object-of-being-decorated-with-wreath-made-of-*hagaga*-grass,-stick-with-which-killed,-and-rice-heads — thou — pig — because — young-pig — thou — because

impañgadaka *page* *ta* *monkakuyug-kayo* *page* *hagaga*
object sacrificed thou (to) — rice — in-order-that — agent-of-going-in-a-company-ye, — rice, — *hagaga*-grass

wi-wik *ya babui.* *Tumalakdang-kayo* *Kabunian.* *Dutnangyo*
stick-with-which-killed, — and pig. — Agents-of-rising-ye (unto) — Sky-world — Objective-of-arrival-your

hudok nan Ampúal, *Imbagádaka,* *babui,* *dimatayanda*
quarters of Ampual, — Balitian, etc. (as above) — Object-of-telling-thine, — pig, — agents-of-killing-they

he'a; *nañgipadúanda* *babui ke he'a* *humapitka* *babui* *"Impaduyu-ak*
thee, — agents-of-sacrificing-they, — pig of thee: — Agents-of-saying. — thou, pig, — "Was-object-of-sacrifice-

hi *kolating"* *Komali* *din bagol* *ta* *gumikud* *di page,*
at — the harvest-feast" — Agent-of-telling — the spirits — that — agents-of-increasing — the rice,

ta *humañgali* *di page* *ta* *ihigup*
that — agents-of-increasing-miraculously — the rice, — in-order-that — object-of-being-brought (to)

natdañgan *di hinumpkal.* *Adika mahduman.* *Ugikabo*
place-for-ripe-grain (of the granary) — the plenty. — Do-not-thou-be mute. — Do-not-thou-either

maginaginluk, *babui.*
(emphatic) be-sleepy, — pig.

harvesters, some of it is distributed to be carried home or cooked at will. Each of the priests gets a good piece. A most striking feature is the lack of variation in the process of cutting up and distributing the pig. The feet are first cut off. The children eagerly contend for these, and only the presence of the elders prevents them from coming to blows. Then the skin and fascia over the belly are cut off, the belly is opened and the entrails are taken out. The gall bladder is inspected for an omen. If it is full and dark—as it nearly always is, for the pig has not eaten for some eighteen to twenty hours—all is well.[62] The chest of the pig then is opened and the blood poured out. Some of the clotted blood is often snatched and eaten by the feasters, for they have fasted since night of the previous day. The triangular fascia under the lower jaw is cut off, the head severed from the body, and the body cut into sufficiently small pieces to go into pots.

The following is the apportionment of the parts of the pig: The head goes to the owner, for when the flesh has been eaten, the skull will be hung up outside the granary; the feet, pancreas, genitals, bladder, and a portion of the liver, to supply the children not already supplied with some part of the animal; the tail[63] to a child or to a man or woman who may desire it; the skin and fascia of the belly, the skin and the fascia under the lower jaw, the heart, and the lungs, to the cook, as pay for his services; the intestines, a highly prized portion, go to the youths who carry the rice to the granary; the remainder is divided among the harvesters and feasters.

I have never seen this allotment varied except in one case. In that instance, the cook, in cutting off the abdominal fascia, which rightfully fell to his lot, cut off some short ribs with it. The bystanders protested that the cook was taking more than his just portion and that he was, in fact, a pig himself.

Continence and the fast during harvest time.—While it usually takes only one or two days for a family, with the aid of relatives, neighbors, and the people who come down from the higher villages, to cut their rice, it is generally five weeks or more from the time the first family begins harvesting until the last one in the village has finished. During this

[62] After the examination, the gall bladder is twisted on a stick, and fixed under the floor of the granary. If by any chance it were empty and dark, it would be necessary to kill another pig.

[63] The tip of the tail, if it be white, is worn by a girl or woman in the hair as an ornament; and by a man at the end of the strings by which the neck ornaments are tied on. See the tips so worn by the dancers in the picture of the blanket dance. Plate VI, fig. 1.

time, continence is the rule for the following classes: Persons of importance, those who have a goodly number of rice fields; persons who take part in the harvest feasts, *monbaki;* and those who stack the rice in the granaries, called *mañgikapia.*[64] The reason given for this practice is that the *bagol* do not, at this season, approve of earthly pleasures and joys, and punish those who indulge in them not only by not increasing, but by actually decreasing their rice supply. I am informed that continence is strictly adhered to; and I believe that it is so, knowing, as I do, the implicit faith of the people in the tenets of their religion. And, besides this implicit faith, there is the consideration that the members of the three classes mentioned are middle-aged or elderly persons.[65]

During harvest time no Ifugao may eat of the carabao, ox,[66] deer, grasshopper, goat, fish, or snails. It is not forbidden to eat the flesh of the pig, chicken, or duck. Vegetables, except *camotes,* may not be eaten.

This renouncing present pleasures or advantages with the intention of gaining greater advantages of another kind is an old story in religions the world over. Self-denial is pleasing to the divinities; too much prosperity arouses the jealousy of the gods. Who are these mere men that they should have so much happiness? Let them pay for it!

It is very interesting to find in another Igorot tribe, living under very different conditions, an observance of celibacy and fast, from remarkably similar motives. The Igorots of Suyoc, in the Subprovince of Lepanto, live almost entirely upon the proceeds of their mining, the climate of their village not permitting the cultivation of rice. I am informed[67] that when a Suyoc man strikes, or knows that he is about

[64] This office is always performed by elderly men.

[65] The Eskimo have a similar practice during the whaling season. Says Elie Reclus: "During the hunting season, the Aleutians often turned their wives out of doors, forbidding them to cross the threshold of the great *kachim.*" * * * Primitive Folk, p. 58.

"Master whale is also a stickler for morality and virtue; he avoids latitudes frequented by base and dissolute tribes; does not approve of the whalers who have the honor of attacking him compromising themselves with women during the whaling season; he would even punish them by some terrible chastisement if their wives were unfaithful to the conjugal vow during their absence; he would cause them to perish by a cruel death if their sisters failed in chastity before marriage." *Ibid,* p. 55.

[66] In Mayaoyao village the ox is regarded as unclean, and the use of its flesh as food is interdicted altogether by custom. For this information I am indebted to Lieutenant-Governor Jeff D. Gallman.

[67] I am indebted for this information to Major C. E. Nathorst, Philippines Constabulary, and to Mr. Henry Reeder.

to strike, a vein of gold-bearing rock, he quits work, goes home, and offers to his gods a feast lasting two or three days. From the time that he returns to work until the vein or pocket is exhausted, he drinks no rice wine, and eats no flesh nor vegetables. He also remains continent. The reason he gives for this practice is that, otherwise, the spirits would get angry, and would cause the gold-bearing rock to diminish rapidly, and soon to fail altogether. Note the parallelism of the customs and the motives thereof, although the Suyoc man is working his "find" of ore, and the Kiangan man is cutting his rice crop.

ILLUSTRATIONS.

PLATE I.

FIG. 1. Two granaries. General view of the feast.
2. Invocation of the ancestral spirits. Note the position of the hands above the forehead. This is characteristic.

PLATE II.

FIG. 1. The drum. Note *runo* decorated with feathers, betel nuts, etc.
2. A recess between ceremonies.

PLATE III.

FIG. 1. Ceremonial drinking of rice wine. This picture is a pose, and does not begin to indicate the fervor of the feasters during the ceremony.
2. Summoning the *tayaban* with bamboo shakers or *palipal*. (Monligid.)

PLATE IV.

FIG. 1. Man in attitude of shaking *palipal*. Note the shelf for seed rice to the left.
2. Summoning the *púok*.

PLATE V.

FIG. 1. House of the *pili*, a spirit that guards the granary against thieves. Note offering of betel nuts and chicken flesh on the short stick of *runo*.
2. The procession during the summoning of the Bakayauan.

PLATE VI.

FIG. 1. The blanket dance.
2. Ceremonial killing of the pig. The children begin to be in evidence.

PLATE VII.

FIG. 1. Singeing the hair and epidermis. Note the *runo* plug in the pig's breast.
2. Dispatching the spirit of the pig. A pose. Note the ceremonial wreath. In this case *runo* blades were used instead of *hagaga*.

PLATE VIII.

Kiangan rice fields.

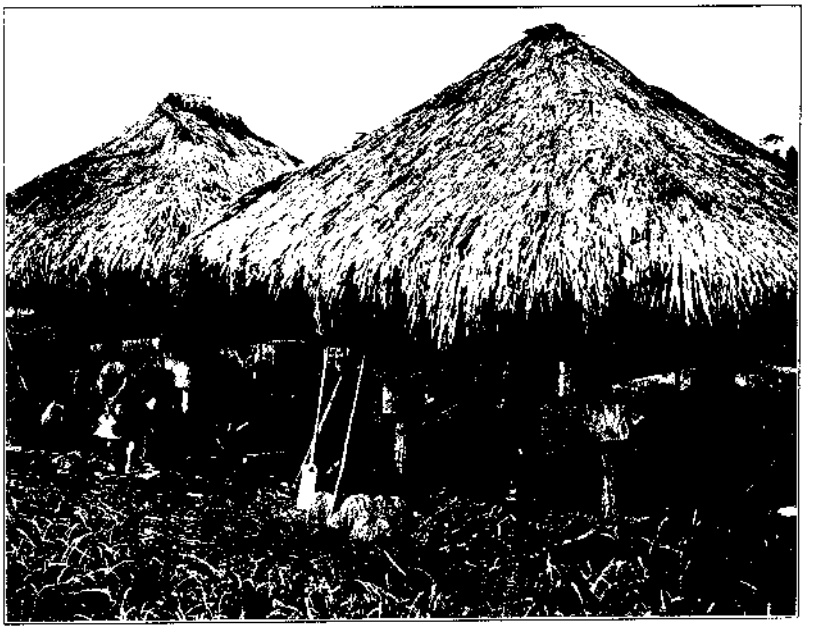

FIG. 1.

FIG. 2.

PLATE I.

Fig. 1.

Fig. 2.

PLATE II.

Fig. 1.

Fig. 2.

PLATE III.

FIG. 1.

FIG. 2.

PLATE IV.

FIG. 1.

FIG. 2.

PLATE V.

Fig. 1.

Fig. 2.

PLATE VI.

FIG. 1.

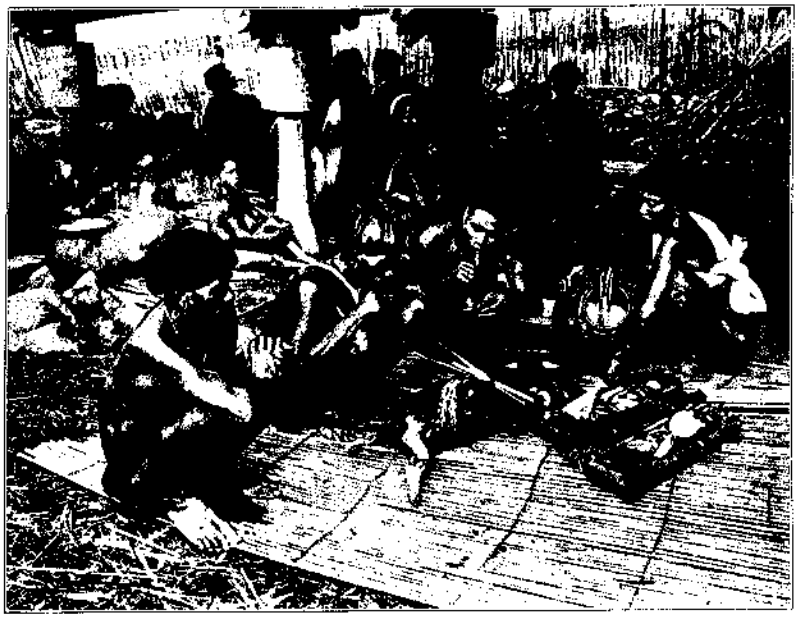

FIG. 2.

PLATE VII.

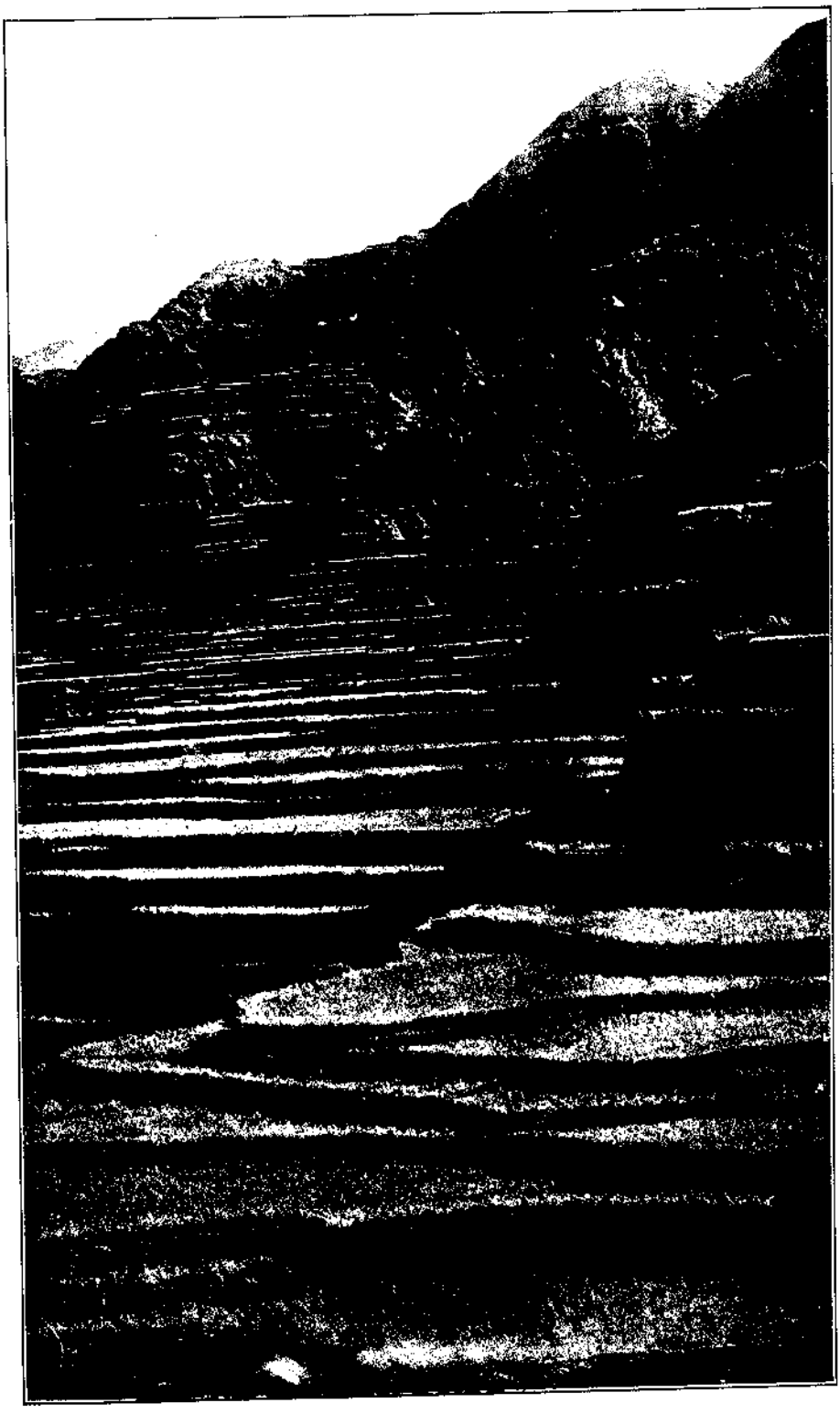

PLATE VIII.

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FILIPINO EARS: III. NEGRITO.

By ROBERT BENNETT BEAN.

(From the Anatomical Laboratory, Philippine Medical School, Manila, P. I.)

The Negritos of the Philippines have been studied at close range by Meyer, Montano, Reed, and others, and from a distance by many anthropologists, including Virchow and Blumentritt. Dean C. Worcester, Secretary of the Interior, has visited Negritos wherever they exist in the Archipelago, and it is through his generosity in placing at my disposal the photographs of his inimitable collection and of the Bureau of Science, from which materials are drawn for this and subsequent studies of the non-Christian tribes, that I am enabled to produce this publication.

This is the first of a series dealing with the ears and other physical characteristics of the Philippine Islanders of the interior, and follows studies previously completed of the ears of Manila pedestrians and riders, Bilibid prisoners, morgue subjects, and the men and women of Taytay, Rizal Province, Luzon.

The Negritos are the first of the non-Christian tribes selected for study, (1) because they are relatively few in number and, undoubtedly, are gradually disappearing, since they lose their purity when they come into contact with surrounding peoples; (2), because very few studies of Negritos have been made dealing with the physical characteristics of the living; (3), because no previous study has been made of their ears; and finally (4), because a large number of representative photographs of Negritos from many parts of the Islands could be obtained.[1]

[1] The photographs have been derived from several sources, and have been taken at various times by different men, therefore some difficulty has been experienced in reproducing them uniformly. The photographs of the Negritos of Bataan or Mariveles Mountain, of Isabela and Pampanga Provinces, and some of those of Palawan Island and elsewhere, were taken by Dean C. Worcester. The Negritos of Zambales were photographed by William A. Reed and others; those of Cagayan by Charles Martin, of the Bureau of Science; the Tinitian and others (Bataks) in the Island of Palawan by Lieutenant E. Y. Miller while he was governor of Palawan Province; and the photographs of the Negritos of the Island of Panay, Provinces of Antique and Capiz, and Ambos Camarines, Luzon, were taken by Doctor M. L. Miller, chief of the division of ethnology, Bureau of Science. These are groups from which photographs are presented, with the addition of a few others.

It is to be noted that Negritos still remain in the Philippines, from Palawan in the south to the extreme northern end of Luzon. Not only is the distribution of the Negritos general throughout the Islands, but the types selected show a similar general distribution, although slight local resemblances exist. The Negritos of a single locality have evidently inbred, yet the possibility of intermixture with the surrounding populations can in no instance be disregarded.

The literature dealing with the Negritos is not available. The monumental work of Meyer has not been accessible, and the only available publications dealing with physical measurements have been limited in the number of individuals measured. The work of Reed [2] represents fairly well the Zambales Negritos in a series of photographs which is a most complete portrayal of a single group, but the physical characteristics are otherwise not treated fully. This is the first attempt ever made, in the manner of this study, to analyze the types of a group of individuals from photographs, and although I present the results with some trepidation, yet I believe my previous studies of the ear and the use of descriptions rather than measurements, enable me to characterize the types with a fair degree of accuracy.

DESCRIPTION AND CLASSIFICATION OF TYPES.

Before beginning the study of the Negrito ears, it may be well to describe the typical Primitive and Iberian ears and physiognomy, because they represent fundamental Negrito types.

Primitive ears are characterized essentially by the inrolled helix with inversion of the concha. This gives the appearance of a hollow bowl with the rim prominent at the upper part of the helix and at the lobule, and depression of the bowl's rim at the ventral and dorsal parts of the ear. A shelf is thus formed both above and below, the internal part of the superior border of the helix forming the superior surface of the upper shelf, and the external part of the lobule the superior surface of the lower shelf. The concha is short in its vertical, and wide in its horizontal, diameter, although this is not invariably true.

Iberian ears are marked essentially by the eversion of the concha and the consequent turning back of the helix, particularly in its lower half. This results in an old-English small-letter *f*-shape of the helix rim as viewed from behind. The lobule is pendant or turned backward toward the head, and frequently is absent as in type B, or square as in type C, in contrast with the lobule of the Primitive, which is turned forward and upward, this point alone often being sufficient to distinguish either of the two types of ears.

[2] Negritos of Zambales, *Ethnological Survey Publications*, Manila (1904), 2, pt. 1.

The Primitive ear is usually round, the Iberian, long. The physiognomy of the Primitive, in general, is broad and flat. The forehead is small and prominent, the brow ridges insignificant. The nose is broad, flat, and depressed at the bridge, which is often totally lacking. The nostrils open somewhat forward rather than downward. The mouth is not wide, but the lips are thick, and the chin is small and receding.

The physiognomy of the Iberian is in every characteristic almost the reverse of the Primitive. The face is long, narrow, and projecting, with considerable facial prognathism, with an acute angle formed by lines joining the glabella with the external auditory meatus. The forehead is square and the brow ridges small. The nose is narrow, high, and long. The nostrils point downward, and do not flare. The mouth is not large, and the lips are thin. The chin is pointed, but often projects slightly instead of receding. The chin and forehead of the Iberian and Primitive are not so unlike as are the other features, the great differences between the two faces being in the middle parts, where width and flatness in the Primitive and narrowness and projection in the Iberian are the distinctive characteristics.

ANTHROPOLOGICAL TYPES ILLUSTRATED BY PHOTOGRAPHS OF EARS.

PLATE I.

The two fundamental ear types, Primitive and Iberian, that characterize the Filipinos wherever I have examined them, apparently form basic types of Negrito ears. These two types of ears on both man and woman may be seen in Plate I. Figures 1 and 2 represent a characteristic Negrito woman of the Primitive type from Mount Mariveles, Bataan Province. But for the bushy head of hair, this photograph would well represent a Primitive Filipino such as may be seen in almost any part of the Islands. The ear can not be seen well but enough of it is shown to reveal the Primitive characteristics. The shelf lobule is seen on the right ear, and the rounded contour, with overturned helix on the left. Other Primitive traits may be seen, such as the broad, flat nose with depressed ridge, flaring nostrils, and apertures that open forward instead of downward; the vertical, or *bombé*, forehead that is particularly small in its transverse dimension; the thick, projecting lips; and the small, receding chin.

The two men of figures 5 and 6 are not so typical of the Primitive as is the woman, but they approach the form more closely than any other male Negritos portrayed. The Negrito men in general are not of the Primitive type, but the majority of the women are of this type, a statement that will become evident as the study progresses.

The woman of Zambales in figures 3 and 4 is said to be Negrito, and if that be true the pure Negrito is a Modified Iberian. The ear has a combination of Primitive and Negrito characteristics. The inrolled,

overturned helix is Primitive, and the slightly everted concha below and pendant lobule suggest the Iberian. The nose is straight, not very wide and flat, and the other features of the physiognomy resemble the Iberian as much as the Primitive. However, this woman is not so good a representative of the Iberian Negrito as the man of Zambales portrayed in figure 8, who is almost a typical Iberian. The ear is long with pendant lobule, everted concha, and spiral helix. The nose is long and straight, and the other features resemble the Iberian. The hair is curly, rather than kinky, and I venture to state that this is a European-Negrito cross.

The man of figure 7, also seen in figures 1 and 2, Plate II, is called by title in Mr. Worcester's catalogue "an excellent type," yet this man has Iberian ears and physiognomy. It is true that they are not perfect Iberian, but the ear has an everted concha, slightly spiral helix, and somewhat dependent lobule. The nose is straight and somewhat pointed. Other features resemble the Iberian.

PLATE II.

The remainder of the Negritos represented in Plate II are also of the Iberian type. Figures 3 and 4 are photographs from the negatives used by Keane on pages 220 and 222 of The World's Peoples to represent a Negrito of the Philippines. The ear can not be seen well but presents the everted concha and pendant lobule characteristic of the Iberian, and the sharp, straight nose, and other characteristic features also denote the Iberian. Keane also gives a picture of "Ardi, one of the last of the Kolangs," the aborigines of Java, whose ear is Iberian in type, not unlike that of the Negrito in Plate I, noted by Mr. Worcester as "a full-blood." The physiognomy of Ardi, who is called by Keane "the most ape-like of men," is that of a degenerated Iberian.

Figures 5 and 6 are rather good photographs of Pagatolan, a Negrito chief of Isabela, who "has had three albino children, two of whom are living and to one of whom he had given Christian baptism. He states that God has been very good to give him white children, and that he proposes to send them to school." This Negrito is decidedly Iberian. The long, straight, pointed nose, the pointed chin, and the square forehead are all evidences of the Iberian. Unfortunately the ears do not show well, although the lobule and lower helix and concha resemble the Iberian. The albino children may be expressions of Mendelian heredity from a previous European-Negrito cross.

Figures 7 and 8 represent a Negrito said to be of pure type (Reed, Plate XII), but again the Iberian is evident. However, the ear is not of unmixed type and the Iberian traits are not very well marked, although the concha is everted, and the lobule is square.

PLATE III.

This plate exhibits Negrito women of the Primitive or Modified Primitive types from Ambos Camarines, Mount Mariveles, and Palawan Island. It is needless to point out the Primitive characteristics, but the broad, flat nose with depressed bridge and nostrils that open more forward than downward, and the shelf-like lobule of the ear may be seen on each individual.

It may be of interest and significance that the Negrito women shown in all the photographs are almost entirely of the Primitive type, whereas the men are Iberian. If Pearson's law be true, that males inherit more from the father's side and females from the mother's, then the men who have impregnated the Negrito women were of the Iberian type and the impregnated women were of the Primitive.

PLATE IV.

The Negritos portrayed in Plate IV are variable blends of the Iberian and Primitive. Figures 1 and 2 represent a purer Iberian ear than the others. The concha is everted, the lobule attached directly to the cheek at its lower margin, and there is a slight outward twist of the upper part of the helix. The other features are blended, although the nose is slightly aquiline. Figures 3 and 4 represent a less pure Iberian ear than figures 1 and 2. The ear has a Primitive bend or knee at the junction of the lower and middle thirds, and the lobule tends to form a shelf, but does not quite perfect the tendency. The nose is large and straight and the other features are neither perfect Iberian nor perfect Primitive. The Negrito of figures 5 and 6 is less Iberian and more Primitive than the one of figures 3 and 4. The ear is very slightly Iberian in the eversion of the concha and slightly spiral helix, whereas the Primitive characteristics are marked in the rounded contour, outward, overturned, upper helix, and shelf-like lobule. The other features are blended Iberian and Primitive.

The Negrito of figures 7 and 8 is very slightly Iberian, although the nose is somewhat straight and the nostrils open downward. The ear is blended, with Primitive characters predominating.

PLATE V.

Plate V presents variable, female blends. However, each partakes largely of the Primitive type, and in none is the Iberian very well marked. Figures 1 and 2 show almost pure Primitive ears, although the nose is not Primitive. Figures 7 and 8 show forms simulating Iberian, but the Primitive ear is still apparent. The forms of figures 3, 4, 5, and 6 are blends of varying nature more or less intermediate between those of figures 1 and 2, and 7 and 8. The women again present Primitive, and the men Iberian, characteristics in the blends as in the purer types.

PLATE VI.

However, Iberian characteristics may appear in hybrid, female Negritos. Evidence of this is furnished in Plate VI, figures 1 and 2, which represents an old Negrito mestiza. The left ear is almost typical Iberian, with everted concha, pendant lobule, and spiral helix, whereas the right ear is somewhat more Primitive in character, with a slightly shelf-like lobule and overturned superior helix, although the latter may be due to pressure from the overhanging hair. The nose is straight and neither very wide nor flat, and the skin appears light in color.

In figures 3 and 4, Iberian characteristics of the ear also appear, although less marked than in figures 1 and 2, but the other Iberian characters, although present to some extent, are not so well seen.

Figures 5, 6, 7, and 8 are placed alongside each other to illustrate two old Negritos with Modified Primitive characteristics.

PLATE VII.

Other ear types, besides the Primitive and Iberian and their blends, appear among the Negritos. The Alpine ear of the same nature as that observed on many Filipinos other than Negritos may be seen in Plate VII. Figures 1 and 2 represent a so-called pure Negrito of Ambos Camarines. The ear is Alpine, having a shelf-like lower helix inserted diagonally downward into the cheek. The ear does not form a double shelf above and below by the turning in of the helix at its upper and lower parts, but there is a slight turning at both ends which indicates Primitive characters. There is also a slight spiral twist to the helix, an eversion of the concha, and the insertion of the lower helix or lobule which suggests the Iberian. Therefore this ear must be considered as an intermediate form of the Primitive and Iberian, retaining qualities of both, yet different from either, forming a kind of mosaic, which is a true ear-type.

The physiognomic characteristics of this man are also intermediate between the Iberian and Primitive. The nose is neither broad and flat nor long and straight, the forehead is both square and *bombé;* the lips are not full, nor is the chin markedly receding. Figure 5 represents another Negrito man from Ambos Camarines; here the ears are also Alpine, although slightly more like the Primitive than in the other Negrito from the same place.

The Negrito man of figure 6 is also a Camarines native with Alpine ears, in which the Iberian qualities somewhat overshadow the Primitive.

The other features of the two men are those of the Alpine type, either a blend of Iberian and Primitive or a mosaic of the two. The four remaining figures (3, 4, 7, and 8) of Plate VII probably represent crosses between the Negritos and neighboring Malays, and they portray men of the Alpine type. The character of the ears and physiognomy

of the man in figures 3 and 4 is nearer the Iberian than the Primitive, and the same features of the man in figures 7 and 8 are nearer the Primitive than the Iberian.

PLATE VIII.

Plate VIII illustrates variable forms resembling the Alpine, although none are perfectly true types, but rather a group of atypical, Alpine ears resembling both Primitive and Iberian, some more like one type and some more like the other. Figures 1 and 2 represent a Mariveles Negrito man more Iberian than Primitive; figures 3 and 4 represent a Negrito man from the Island of Burucay, a part of the Province of Capiz, off the northwestern point of the Island of Panay, who is more Primitive than Iberian. The man in figures 5 and 6 is a Negrito from Casablanca, Cagayan Province, northern Luzon, who is probably also more Primitive than Iberian. Figure 7 is almost an Iberian, and figure 8 is almost a Primitive; the one, a man from the Island of Burucay, "with considerable Visayan blood," and the other, the "chief of the Mariveles tribe, who is a typical Negrito, and, like many of the men of his tribe, has quite an abundant growth of hair on the face."

The many forms of blended ears intermediate between the Iberian and Primitive belong to the Australoid type wherever the ear form is not that of the Alpine. The Negrito-Australoid is not unlike the Filipino-Australoid from different parts of the Islands, and the characteristic, large, straight nose may be seen on practically all the photographs of this type. It is well marked in all the figures of Plate VIII.

PLATE IX.

The Australoid nose may be seen clearly in figures 1, 2, 3, and 4, Plate IX, and somewhat modified in figures 5, 6, 7, and 8 of the same plate. The ears are all modified Primitive, and may be called Australoid ears.

PLATE X.

The ears previously described in this study have been similar to those of other Filipino populations throughout the Archipelago and no distinctive Negrito ear has been demonstrated. However, there is a type of ear that is presented as the true Negrito ear, although it may prove to be only a variant of one of the forms previously described, or it may be Australoid. It is seen distinctly in figures 1, 2, 3, and 4 of Plate X (and in figs. 3 and 4 of Pl. IV), in combination with the Australoid nose. It is seen in modified form in figures 5, 6, 7, and 8, where the nose is also somewhat modified. The characteristic of this ear is the offset in the helix at the point where the lobule begins. This is in the form of an indentation on both the ventral and the dorsal surface of the helix, and gives a shelf similar to that of the Alpine ear, although the lobule does not pass immediately to the cheek, but projects downward

and forward in a rigid, rounded point. This ear form is simulated by many that have Primitive characteristics, as may be seen in Plate A where the three Negritos from Pampanga have this ear type. The Australoid nose is especially plain in the man in the center of Plate A.

PLATE XI.

The true Negrito ear is seen in modified form in all the figures of Plate XI where the nose is not typically Australoid, but also modified. Observations of living Negritos, with physical measurements, may be necessary to determine the relation of this ear to the physical type. At present it appears to be one of the most frequent forms and apparently the true ear-type. It may be regarded as a blended type derived from the Primitive and Iberian which has been differentiated from both in the processes of fusion.

PLATE XII.

Plate XII is presented to illustrate the results of combinations of types that have intermingled, and thus enables us to understand the processes by which amalgamation progresses. Figure 1 is an Iberian Filipino with perfect, Iberian, type A of ears, probably a Spanish-Filipino mestizo. If such a man should impregnate a Negrito woman of the Primitive type seen in figure 2, the result might be the production of two individuals similar to those in figures 3 and 4, where blending is evident. The further impregnation of Negrito women by such blended individuals might produce men similar to those portrayed in figures 5, 6, 7, and 8, in which the kinky hair and dark skin of the Negrito appear because they are dominant, and in which the Iberian and Primitive ears and physiognomy remain blended to some extent, although one may partake more of the Primitive and another of the Iberian. The union of individuals of the blended type might also reproduce according to Mendel's law; the offspring would then be in the ratio of three Negrito Primitives to one Filipino-Iberian, provided the former is dominant.

DISCUSSION.

Three possibilities in the heredity of Iberian and Primitive characters are apparent from the study of the ears and physiognomy of the Negritos: First, there is blending with the production of a hybrid that has curly or wavy hair, ears that are part Iberian and part Primitive without the distinctive characters of either, and a nose that is straight, yet wide and not high; second, there is persistence of both Iberian and Primitive ears and physiognomy, each type accompanied by kinky hair; third, there is a mosaic ear, the Alpine, some parts of which are Primitive and others Iberian, and which, slightly modified, occurs in connection with kinky hair and Iberian physiognomy.

It remains to be determined exactly what takes place in the heredity

of cross-bred races such as the Iberian and Negrito, or the Filipino and Negrito, but the indications are that there is blended heredity, mosaic heredity, and persistence of type which suggests Mendelian heredity. There exist among the Negritos forms of hair, nose and ear, as well as other features of the physiognomy, intermediate at almost every conceivable point between the widest extremes, and the general effect is that of disorderly blendings as represented previously by a scheme for heredity of type.

Several suggestions seem pertinent. The Negrito was originally of the Primitive type and contact with the Iberian has resulted in the production of various new forms, such as the Alpine and Australoid, with the retention of the two other types, Primitive and Iberian; or the Negrito was originally of the Australoid type and has been impregnated with the Primitive and Alpine through the Malay migrations, and the Iberian through the Spanish occupation of the Philippines, with the retention of these types and the formation of intermediates between them; or, the Negrito was originally Iberian and has become mixed with Primitive, Alpine, and Australoid forms through subsequent infusions from various sources; or, the Negrito was originally of a composite form embodying the Primitive, Australoid, and Iberian, from which these and other types have arisen; or, the true Negrito form has become lost through incessant intermingling, leaving only the small size, dark skin, and kinky hair; or, the Negrito represents a degenerated product with many possible forms tucked away under the kinky hair and dark skin; or, various combinations of all these suggestions may be the truth.

Whatever may have been the conditions, there can be no doubt that the Negrito of the Philippines is not a pure race, but one composed of at least two forms, the Primitive and the Iberian, which are almost exact antitheses in the cardinal anthropomorphic qualities, and of the Australoid, which is a combination of the two forms.

The most plausible hypothesis as to the composition of the Negritos is that they were originally of the Primitive type, and subsequently became impregnated with the Iberian, because the women are largely of the Primitive type and the men of the Iberian. The Iberian impregnation must have come at a time previous to the Spanish possession of the Islands, or at least it was other than Spanish or even than Filipino or Chinese, or else there would be found Negrito types similar to the Adriatic, Cro-Magnon, and B. B. B., all of which are present in the living Spanish, Chinese, and Filipino population of the Philippines, unless it be that these types, which are greater in size than the Iberian, are incapable of impregnating the Negrito and fecundity is possible only with the Iberian. It is probable that the Iberian and Primitive united in the Negrito before their arrival in the Philippines, or at a very

early period in the Philippines before the arrival of the first Malay migration; therefore, their origin should be sought elsewhere, probably in Asia.

Davenport's hypothesis, that straight hair is recessive and kinky or curly dominant, is corroborated by finding many straight-haired forms, such as the Iberian and Primitive, with kinky hair, although blending in hair-form is evident among the mixed Malay Negritos. This does not necessarily imply that straight hair would not be dominant and curly hair recessive under different conditions, as among the other peoples of the Philippines not Negritos, where the kinky hair of the Negrito has probably often appeared and, I believe, disappeared. Probably the truth of the matter is that when two extremes of hair-form are crossed, such as the Malay and Negrito, the first results are blends, with afterwards a return, more or less pure, to the original forms; but in the end the kinky hair of the Negrito is retained when the cross takes place continually among the Negritos, and the straight hair when the crossing is continually among the Malays. In this manner extraneous types are bred out.

The photographs of the Mariveles Negritos were all placed upon a large table before me, and when I scrutinized them carefully I realized that I was looking into the familiar faces of a people among whom I was born and with whom I grew up. Practically every face recalled youthful associations, and every individual of the Mariveles group has its counterpart among American Negros.

The photographs of the Negritos from other parts of the Philippines were likewise disposed upon a large table, replacing the Mariveles Negritos; the familiar faces of the homeland vanished, but in their places appeared the faces that one meets every day in Manila or in the provinces, familiar Filipino types. A few of them still resemble the American Negro; this is particularly true of the Negritos of Isabela Province.

These casual observations must be taken with reservations, because no data can be given to substantiate them; but I believe they indicate a close relationship between the Negrito of the Philippines and the African Negro.

ANTHROPOLOGICAL TYPES ILLUSTRATED BY FULL-LENGTH PHOTOGRAPHS.

PLATE XIII.

Plates XIII to XVII represent the full figure of Negritos, and most striking differences may be seen in the length of the lower extremities of different individuals, and in different groups. The six Mariveles Negritos in Plate XIII have relatively long lower extremities; one is a very tall Negrito, his stature being due to his great leg length. This man is as tall as the average European, judging from the photograph taken by the side of Dean C. Worcester, who writes, "this is the tallest Negrito man I have ever seen."

The Mariveles Negritos are mixed Iberian or Australoid in type without exception, all having the big, straight nose characteristic of the Australoid.

PLATE XIV.

The Negritos of this plate decrease in the relative length of the lower extremity from left to right, and the type varies from Australoid to Primitive with the decrease of relative leg length. The two Negritos on the left, figures 1 and 2, are Australoid or Modified Iberian, the two on the right are Primitive or Modified Primitive, and the two in the center are intermediate forms. The Negrito of figure 1 is from Mariveles Mountains and the Negrito of figure 6 from the neighboring Zambales Mountains, but in spite of the proximity of their abodes they are very unlike. The differences apparent here are the long legs, face, and nose of the Mariveles Negrito and the short legs, short, wide nose, and short, wide face of the Zambales Negrito. These differences indicate Iberian affinities for the Mariveles Negrito, and Primitive for the Negrito of Zambales. The differences are apparent, not only in these two individuals, but also in the two groups from the Provinces of Bataan and Zambales. Negritos from other parts of the Islands resemble one or the other group, but are usually intermediate, and represent greater blending with the surrounding population.

PLATE XV.

The Zambales Negrito of figure 2 with short legs is here contrasted with a Negrito of Cagayan Province in figure 1 with intermediate leg length and a Negrito of Isabela Province in figure 3 with long legs. The Zambales Negrito is almost pure Primitive, the Isabela Negrito almost pure Iberian, and the Cagayan Negrito is intermediate in type, the result of Malay or Igorot mixture rather than Negrito. The small Negrito boy of figure 5 with short legs may be contrasted with the old Negrito man of figure 4 with intermediate leg length. This boy is from Cagayan, and when full-grown would probably have legs of intermediate length. An illustration of three small Negrito boys of Mariveles Mountain would have been presented showing long legs in youth, although relatively not so long as those of the adult Negritos of Mariveles, but the photograph was not good enough for reproduction. One may infer from this that relatively short legs represent a youthful condition, but the relative length of individual development is not enough to overcome that of conditions due to type, at least in this instance. In other words, phylogeny is of stronger or greater extent than ontogeny. There is a greater difference between the Mariveles Negritos and the Negritos of Cagayan than between the men and the boys of Mariveles or between the men and the boys of Cagayan.

PLATE XVI.

The Negritos shown on Plate XVI are all mixed with the surrounding peoples and partake of their characteristics. The leg length is intermediate, although the central figure, a Negrito from Cagayan, has relatively shorter legs than the others.

PLATE XVII.

The Zambales Negritos shown on Plate XVII are very much mixed in type, and the variable length of leg indicates the mixture as much as any other character. The men on the right of each figure have shorter legs than the others, and the man next to the one on the left in figure 1 and the one next to the right in figure 2 have longer legs. Here, as elsewhere, the Primitive characteristics go with short legs and the Australoid with long legs.

SUMMARY.

The Mariveles Negritos, who are apparently purer in type than any other group and who are largely of the Iberian and Australoid types, have relatively longer lower extremities than any other group of Negritos represented by photographs; the Zambales Negritos, who are largely mixed and of the Primitive type, have relatively shorter lower extremities than any other group; and the remaining groups, who are also much mixed and intermediate between the Iberian and the Primitive, have lower extremities of intermediate length.

It would appear from the photographs of the full figure that the purest Negritos are to be found in the Mariveles Mountains, and these Negritos are of the Australoid type, which is probably a combination of Iberian and Primitive that has almost reached the stage of complete amalgamation. The Iberian characteristics are more or less pure in some individuals, the Primitive are likewise more or less pure in some, but the greater part represent a complete blend of the Iberian and Primitive that conforms to the type previously designated by me as Australoid, which is found among the Igorots and all the littoral Filipinos so far examined.

CONCLUSIONS.

Any conclusion reached after a study of the photographs presented must be tentative and subject to revision. However, it does appear that there are many inseparable factors in the composition of the individual, such as the ear form, nose and face form, length of the extremities, that constitute a *character-complex* which exists as an entity and in inheritance may act as a unit character.

A character-complex is that group of characters, such as the broad head, broad nose, broad face, and characteristic ear that, combined with small stature, constitute the Primitive species, which character-complex usually hangs together in heredity, but may break up to form new character-complexes.

There is blending of one character-complex with another, but this blending probably does not take place at once upon crossing two extremely different character-complexes such as the Iberian and Negrito, but results in the reappearance of one or the other character-complex in pure form as shown in figure 8, Plate I, where the true Iberian is obscured by having kinky hair and dark skin.

From this follows the second conclusion, which is that the kinky hair is dominant to the straight hair when the cross takes place among the Negritos, therefore a character-complex may be obscured by the kinky hair, so that an otherwise pure Iberian may appear to be a Negrito because of the character of the latter characteristic.

The Negritos of Mariveles Mountain appear to be the purest Negritos in the Philippine Islands, judging from the photographs. All other groups of Negritos are more like the surrounding population. Therefore, the Negritos of Mariveles should represent the fundamental Negrito type, and, as they are largely Australoid, the fundamental type of the Negritos should be Australoid. However, the Australoid is composed of the Primitive and Iberian types which have fused in a disharmonic manner, forming a mosaic. Modified Primitive and Modified Iberian Negritos are also found in the Mariveles group. The women are more Primitive than the men, who are more Iberian and Australoid than the women. The Primitive and Iberian characteristics of the Mariveles Negritos are of such a nature that they should be considered as remnants of the fusion which must have progressed for many centuries or even thousands of years to have produced so homogeneous a blend.

May it be presumed that the Primitive and Iberian types conjoined in prehistoric times at some place in eastern Asia or near by, and by fusion produced the Negrito? From this union innumerable offshoots have sprung in southern Asia, in the islands bordering that region, and also in Africa. The Primitive type remains pure in parts of the East, and the Iberian in Europe. If this hypothesis be untrue, the reverse of it should be considered: The Negrito forms the basic stock of all humanity, and the Iberian of Europe on the one side and the Primitive of the Orient on the other are derivatives. If neither hypothesis be *workable*, then the Negrito of Mariveles has Primitive and Iberian characteristics ingrafted from without. Whatever may be the cause of the condition, there are three types found among the Negritos: the Australoid, the Primitive, and the Iberian; and these three types are found also among all the other peoples of the Philippines wherever I have examined them. The Primitive and the Australoid types, and doubtless the Iberian, are found in all the islands of the Pacific where search has been made and careful analysis of the people has followed.

The more profound the study of mankind, the more profound becomes the impression that the Primitive and Iberian are two fundamental types.

ILLUSTRATIONS.[1]

PLATE A. TRUE NEGRITO EARS.

FIG. 1. Negrito man of Pampanga Province, showing pointed teeth. (Photograph by Worcester.)
2. Negrito man of Pampanga Province. (Photograph by Worcester.)
3. Negrito woman of Pampanga Province, showing pointed teeth. (Photograph by Worcester.)

PLATE I. MODIFIED PRIMITIVE AND IBERIAN NEGRITOS.

FIGS. 1 and 2. Front and side views of head of full-grown Negrito woman of Bataan Province. Primitive. (Photograph by Worcester.)
3 and 4. Front and side views of head of Negrito woman of pure blood, of Zambales Province. Modified Iberian. (Photograph by Worcester.)
5. Pure Negrito of Ragay, Ambos Camarines Province. Lives near town and works for Filipinos. Primitive. (Photograph by Worcester.)
6. Head of full-grown Negrito man of Bataan Province. This man is a full-blood and is an excellent type. Modified Iberian. (Photograph by Worcester.)
7. Head of Negrito man of Zambales Province. Modified Primitive. (Photograph by Worcester.)
8. Side view of a Negrito man of mixed blood, of Zambales Province. He evidently has had the back of his head shaved but the hair has begun to grow again. Iberian. (Photograph by Diamond.)

PLATE II. MODIFIED IBERIAN NEGRITOS.

FIGS. 1 and 2. Front and side views of full-grown Negrito man of Bataan Province. (Photograph by Worcester. See Plate 1, fig. 6.)
3 and 4. Front and side views of Negrito man of Zambales Province.
5 and 6. Front and side views of head of Pagatolan, a celebrated chief among the Negritos of Isabela Province. (Photograph by Worcester.)
7 and 8. Front and side views of head of an old Negrito of Zambales Province.

PLATE III. PRIMITIVE NEGRITOS.

FIG. 1. Negrito woman at Ragay, Ambos Camarines Province. (Photograph by Miller.)
2. Negrito woman near Batobalani, Ambos Camarines Province. (Photograph by Miller.)
3 and 4. Front and side views of head of Negrito woman near Batobalani, Ambos Camarines Province. (Photograph by Miller.)

[1] The descriptions used in these illustrations are taken from Mr. Worcester's catalogue.

FIG. 5. Side view of head of typical Negrito woman, Bataan Province. (Photograph by Worcester.)

6. Negrito woman near Batobalani, Ambos Camarines Province. (Photograph by Miller.)

7. Batak woman (type 8), Palawan Island. Profile view. (Photograph by Worcester.)

8. Profile view of young married Negrito woman of Bataan Province who is suffering from a scaly disease of the skin common among the wild tribes of the Philippines. (Photograph by Worcester.)

PLATE IV. VARIABLE BLENDS OF PRIMITIVE AND IBERIAN NEGRITOS.

FIGS. 1 and 2. Captain Fernando del Barco. Negrito man near Batobalani, Ambos Camarines Province. Modified Iberian. (Photograph by Miller.)

3 and 4. Side and front views of chief of the Mariveles tribe of Bataan Province, who is a typical Negrito, and like many of the men of his tribe, has quite an abundant growth of hair on the face. Blend. Australoid? (Photograph by Worcester.)

5 and 6. Front and profile views of young Negrito man, Bataan Province. Blend. (Photograph by Worcester.)

7 and 8. Front and side views of Negrito man, Capiz Province, Panay, of nearly or quite full blood. Modified Primitive. (Photograph by Miller.)

PLATE V. VARIABLE BLENDS OF IBERIAN AND PRIMITIVE NEGRITOS.

FIG. 1. Profile view of Negrito woman of Zambales Province. Modified Primitive.

2. Side view of young unmarried Negrito girl of Bataan Province. Modified Primitive. (Photograph by Worcester.)

3. Side view of Negrito girl of Zambales Province. Blend. (Photograph by Diamond.)

4. Side view of middle-aged Negrito woman of Bataan Province. Blend. (Photograph by Worcester.)

5 and 6. Front and side views of Negrito woman, Cagayan Province. Blend. (Photograph by Martin.)

7. Old Negrito woman of Zambales Province. (Photograph by Miller.)

8. Side view of Negrito woman of Pampanga Province. Modified Iberian. (Photograph by Worcester.)

PLATE VI. MODIFIED IBERIAN AND PRIMITIVE NEGRITOS.

FIGS. 1 and 2. Front and side views of old Negrito woman of Cagayan Province. Modified Iberian. (Photograph by Martin.)

3 and 4. Front and side views of Negrito man near Batobalani, Ambos Camarines Province. Modified Iberian. (Photograph by Miller.)

5 and 6. Front and side views of a very old Negrito woman of Bataan Province. Primitive. (Photograph by Worcester.)

7 and 8. Front and side views of an old Negrito man of Zambales Province. Primitive.

PLATE VII. NEGRITO ALPINE EARS AND TYPES.

FIGS. 1 and 2. Front and side views of pure Negrito of Ragay, Ambos Camarines Province. Lives near town and works for Filipinos. (Photograph by Miller.)

3 and 4. Dumagat man of Kalawat, Kalawat Island. Probably a cross between Negrito and Malay. (Photograph by Miller.)

FIG. 5. Negrito man at Batobalani, Ambos Camarines Province. (Photograph by Miller.)

6. Negrito man at Ragay, Ambos Camarines Province. (Photograph by Miller.)

7 and 8. Front and side views of young Batak man (Type 1) of Tinabog, Palawan Island. Note the typical hair-cut. (Photograph by Worcester.)

PLATE VIII. VARIABLE ALPINE NEGRITOS.

FIGS. 1 and 2. Front and side views of old Negrito man of Bataan Province. (Photograph by Worcester.)

3 and 4. Front and side views of Negrito man of nearly or quite full blood, of Capiz Province, Panay. (Photograph by Miller.)

5 and 6. Front and side views of Negrito man of Cagayan Province. (Photograph by Martin.)

7. Side view of Negrito man of Capiz Province, Panay, with considerable Visayan blood. (Photograph by Miller.)

8. Side view of chief of Mariveles tribe, Bataan Province. See Plate IV, figs. 3 and 4. (Photograph by Worcester.)

PLATE IX. AUSTRALOID NEGRITOS.

FIGS. 1 and 2. Side and front views of Negrito man of Capiz Province, of nearly or quite full blood. (Photograph by Miller.)

3 and 4. Side view of chief of Mariveles tribe, of Bataan Province. See Plate IV, figs. 3 and 4. (Photograph by Worcester.)

5 and 6. Front and side view of full-blood Negrito woman of Zambales Province. (Photograph by Diamond.)

7 and 8. Front and side views of young Batak woman (type 8) of Tinabog, Palawan Island. Note the head ornaments and the method of carrying cigar thrust in the head dress. (Photograph by Worcester.)

PLATE X. TRUE NEGRITO EARS. AUSTRALOID?

FIGS. 1 and 2. A Negrito man of Cagayan Province. This man had the curly hair of his race, but managed through frequent combings to straighten it out to its present condition. He also used some special kinds of native oils to attain this purpose. Note the expression given to the countenance by the unusual condition of the hair. (Photograph by Martin.)

3 and 4. Front and side views of Negrito boy of Cagayan Province. (Photograph by Martin.)

5 and 6. Front and profile views of full-blood Negrito man of Zambales Province showing beard on chin.

7 and 8. Front and side views of Negrito man of Zambales Province.

PLATE XI. MODIFIED TRUE NEGRITO EARS.

FIGS. 1 and 2. Front and side views of Negrito man of Zambales Province, of pure blood. (Photograph by Diamond.)

3 and 4. Front and side views of Negrito man of mixed blood of Zambales Province. (Photograph by Diamond.)

5 and 6. Front and side views of Negrito man of Zambales Province showing hair on chin. This man has lost an eye. (Photograph by Diamond.)

7. Front view of head of Negrito man of Zambales Province.

8. Side view of head of Negrito man of Zambales Province.

PLATE XII. COMBINATIONS OF TYPES.

FIG. 1. A bright, native school teacher of Santo Domingo de Basco, Batanes Islands. Not a Negrito. Typical Iberian ears. (Photograph by Martin.)
2. Negrito woman of mixed type, Zambales Province. Primitive.
3 and 4. Man of Mount Isarog, Ambos Camarines Province. Shows his Negrito blood. (Photograph by Miller.)
5 and 6. Front and side views of Negrito man of Zambales Province, of pure blood.
7 and 8. Front and side views of Negrito of Zambales Province, known to his fellows as the "Captain-General" of the mountains.

PLATE XIII. MARIVELES NEGRITOS.

FIG. 1. Full length view of typical Negrito man of Bataan Province. (Photograph by Worcester.)
2. Negrito of Bataan Province, the tallest Negrito I have ever seen. It will be noted that his remarkable height is due to extraordinarily long legs. (Photograph by Worcester.)
3. Full length view of typical Negrito man of Bataan Province. (Photograph by Worcester.)
4. Chief of the Mariveles tribe, Negrito of Bataan Province. See Plate IV, figs. 3 and 4. (Photograph by Worcester.)
5. Typical Negrito man of Bataan Province. (Photograph by Worcester.)
6. Full-grown Negrito man of Bataan Province. See Plate I, figs. 1 and 2. (Photograph by Worcester.)

PLATE XIV. LONG-AND SHORT-LEGGED NEGRITOS.

FIG. 1. Negrito man in front of his hut near Batobalani, Ambos Camarines Province. (Photograph by Miller.)
2. A young Negrito of Bataan Province, at his prime with bow and arrow, and boar bristle ornaments on his legs. (Photograph by Worcester.)
3 and 4. Batak man (Type 3), his wife (Type 6) and child, Tinitian, Palawan Island. (Photograph by Worcester.)
5. A Negrito of Zambales Province, of mixed blood.
6. A Negrito of Zambales Province, of full blood. Note relative size of figs. 5 and 6.

PLATE XV. LONG-AND SHORT-LEGGED NEGRITOS.

FIG. 1. A Negrito, standing, of Cagayan Province. (Photograph by Martin.)
2. Typical full-blood Negrito man, of Zambales Province. (Photograph by Diamond.)
3. A Negrito man of Isabela Province, at his prime. (Photograph by Worcester.)
4. A Negrito sub-chief of Isabela Province. (Photograph by Worcester.)
5. A Negrito boy of Cagayan Province. (Photograph by Martin.)

PLATE XVI. NEGRITOS WITH INTERMEDIATE LEG-LENGTH.

FIG. 1. Negrito man near Batobalani, Ambos Camarines Province. (Photograph by Miller.)
2. A young Batak man (Type 2) of Tinabog, Palawan Island. (Photograph by Worcester.)

FIG. 3. Negrito man of Cagayan Province. See Plate X, figs. 1 and 2. (Photograph by Martin.)

4. A young Batak man (Type 1), of Tinabog, Palawan Island. Note the typical hair-cut. (Photograph by Worcester.)

5. A Negrito man near Batobalani, Ambos Camarines Province. (Photograph by Miller.)

PLATE XVII. GROUPS OF ZAMBALES NEGRITOS.

FIG. 1. A group of five Negrito men of Zambales Province, of mixed blood; indeed, the man at the left seems to have no Negrito blood at all and the man at the right has very little. (Photograph by Diamond.)

2. A group of Negrito men, of Zambales Province, mostly old and infirm types. Note rattan tied around their legs below the knees as a cure for rheumatism.

FIG. 1.

FIG. 2.

FIG. 3.

PLATE A.

Fig. 1.

Fig. 2.

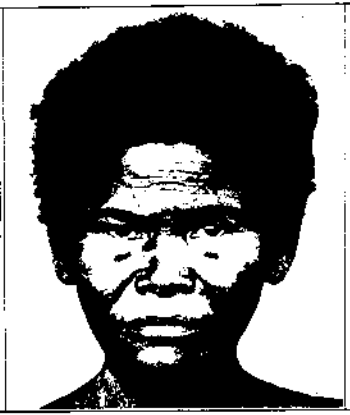

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

PLATE I.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

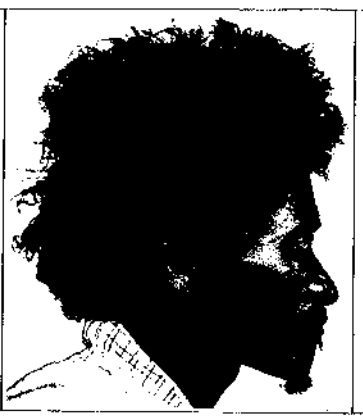

Fig. 6.

Fig. 7.

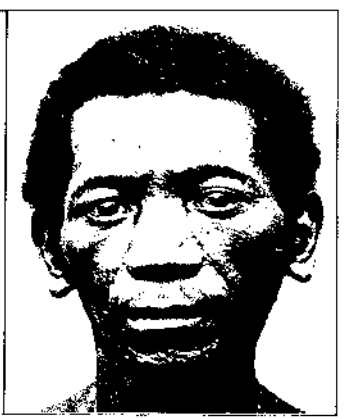

Fig. 8.

PLATE II

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

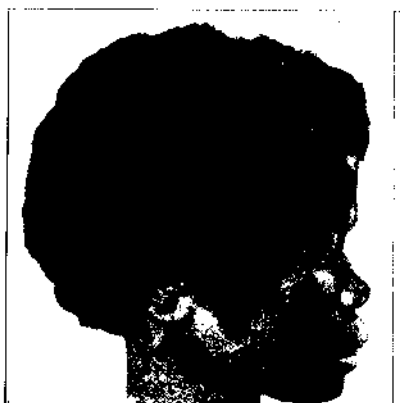

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

PLATE III.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

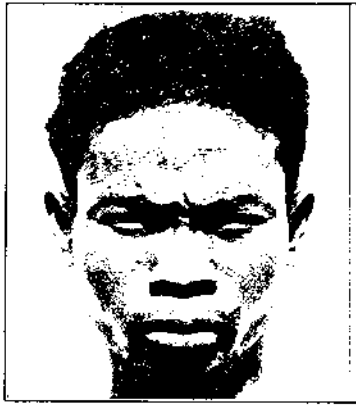

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

PLATE IV.

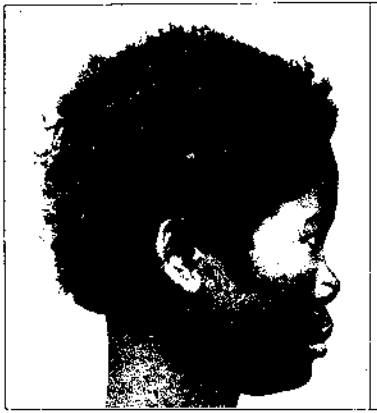

FIG. 1.

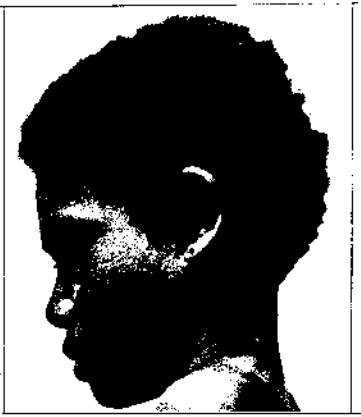

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

PLATE V.

FIG. 1. FIG. 2. FIG. 3. FIG. 4.

FIG. 5. FIG. 6 FIG. 7. FIG. 8.

PLATE VI.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

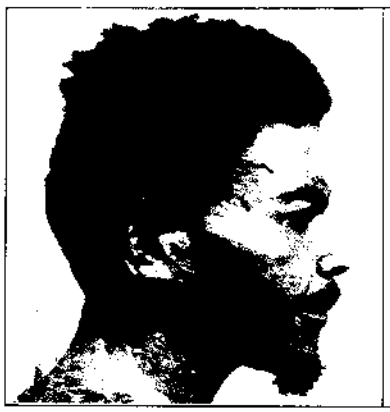

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

PLATE VII.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

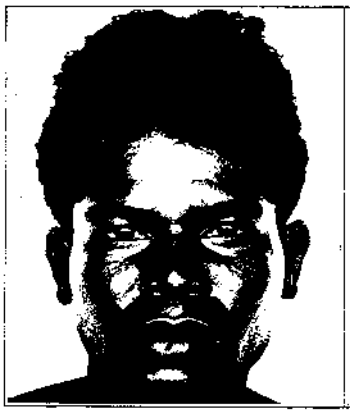

FIG. 5.

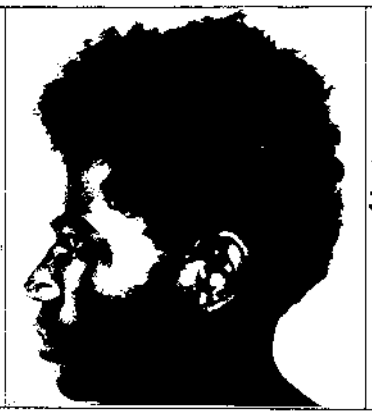

FIG. 6.

FIG. 7.

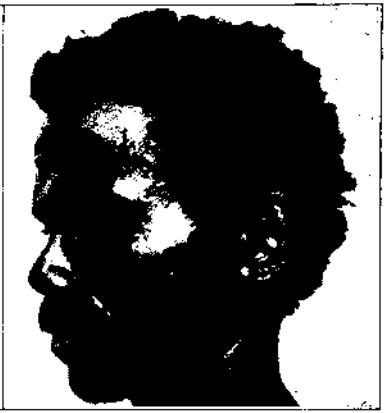

FIG. 8.

PLATE VIII.

FIG. 1.

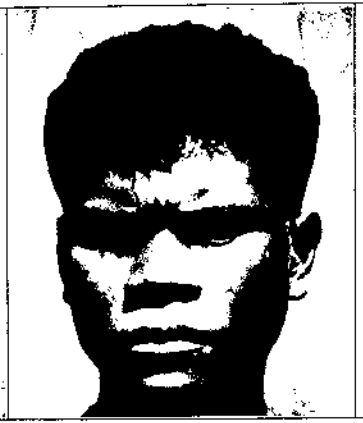

FIG. 2.

FIG. 3.

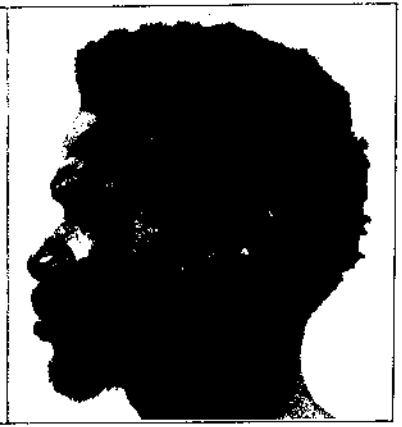

FIG. 4.

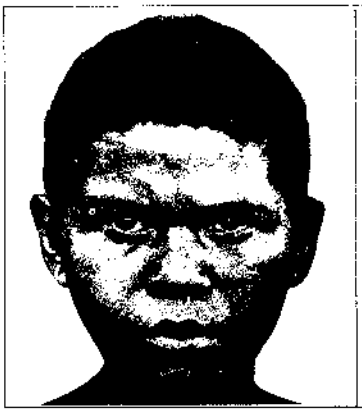

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

PLATE IX.

FIG. 1. FIG. 2. FIG. 3. FIG. 4.

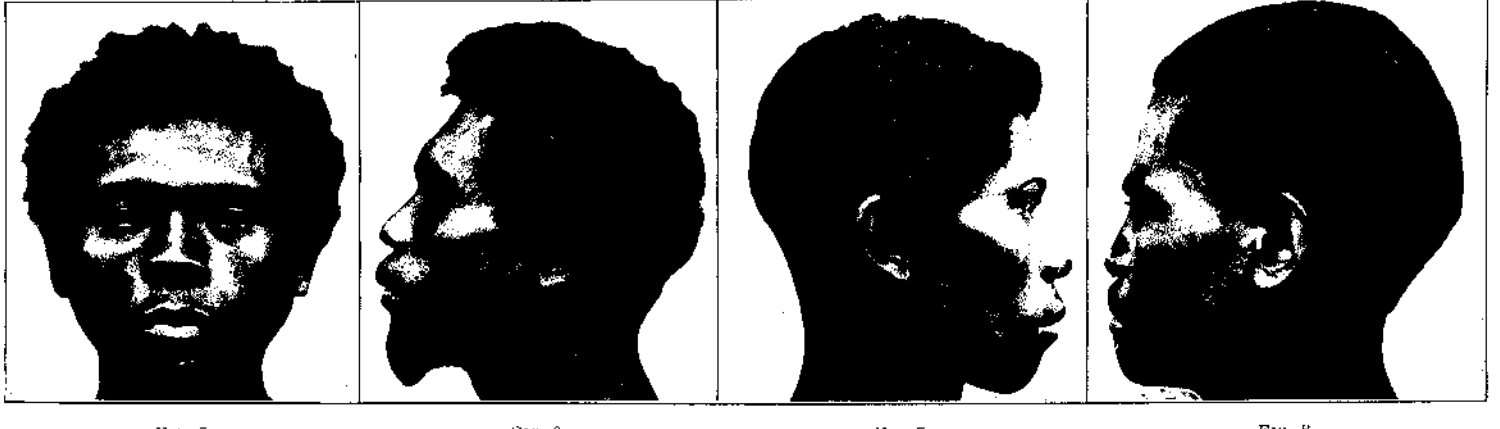

FIG. 5. FIG. 6. FIG. 7. FIG. 8.

PLATE X.

FIG. 1. FIG. 2. FIG. 3. FIG. 4.

FIG. 5. FIG. 6. FIG. 7. FIG. 8.

PLATE XI.

FIG. 1. FIG. 2. FIG. 3. FIG. 4.

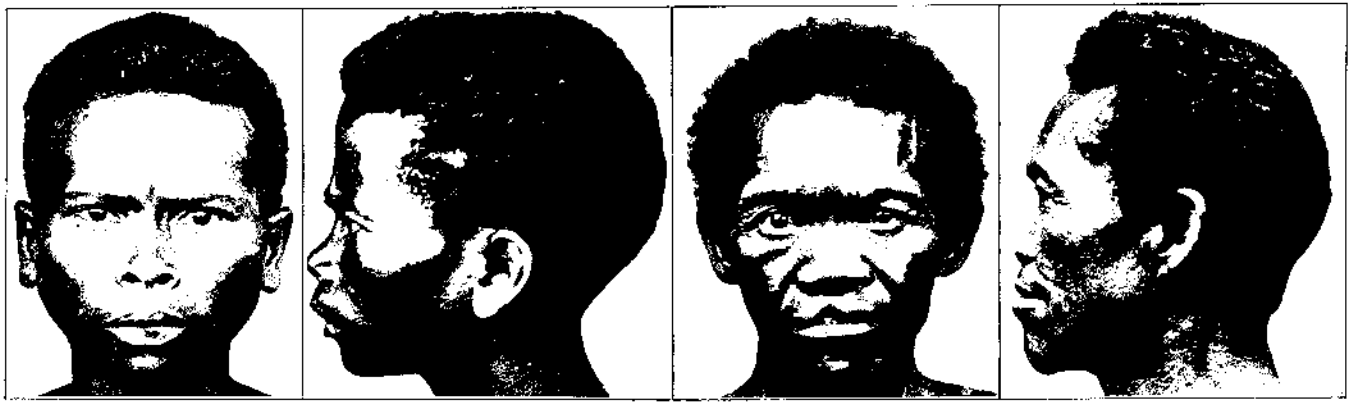

FIG. 5. FIG. 6. FIG. 7. FIG. 8.

PLATE XII.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

PLATE XIII.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

PLATE XIV.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

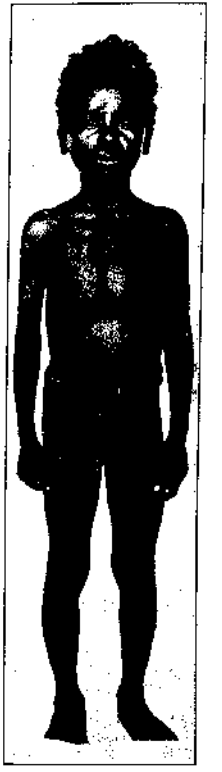

FIG. 5.

PLATE XV.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

PLATE XVI.

FIG. 1.

FIG. 2.

PLATE XVII.

Order No. 415.

IN PRESS.

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By C. B. Robinson.

(Reprinted from Section C, Philippine Journal of Science, Vol. VI, No. 2.)

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Introduction; general and geographical information regarding Negros	9
Mountains, rivers, and climate	11
The sugar-producing districts of Negros	14
History of sugar production in Negros; varieties of cane grown in Negros; cane diseases and insect enemies; nationality of the planters; native labor; difficulties, past and present	16
The soil of Negros compared with that of other sugar-producing countries	68
Average composition of the purple or native sugar cane in Negros; other varieties of cane grown in Negros; cane in the Hawaiian Islands; Egyptian cane; Java cane; Louisiana cane; West Indian cane; Negros as compared with other countries in respect to the quality of cane; desirability of introducing other varieties of cane	76
The cultivation of sugar cane and the production of sugar as carried on at the present time in Negros; preparation of the soil; preparation of the seed; planting; cultural operations after planting; cultivation of ratoon canes; period of growth of the cane; cost of cultivation; cutting the cane; transporting the cane to the mill; cost of cutting the cane and transporting it to the mill	82
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